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3 - Vol

THE

MECHANICS' MAGAZINE,

MUSEUM,

Register, Journal,

AND

GAZETTE,

APRIL 9—SEPT. 24, 1836.

VOL. XXV.

"Who can predict the results of the Spirit of Enterprize, when aided by the Genius of Invention, and propelled onwards by powers which she alone can bring into exercise? The very elements are submissive to her will, and all the endless combinations of mechanism are subservient to her purposes. She participates in almost every business and employment of man. Agriculture itself might as well dispense with fertility of soil, as with her aid in its cultivation."—REPORT ON PATENTS OF SELECT COMMITTEE OF AMERICAN CONGRESS, 1835.

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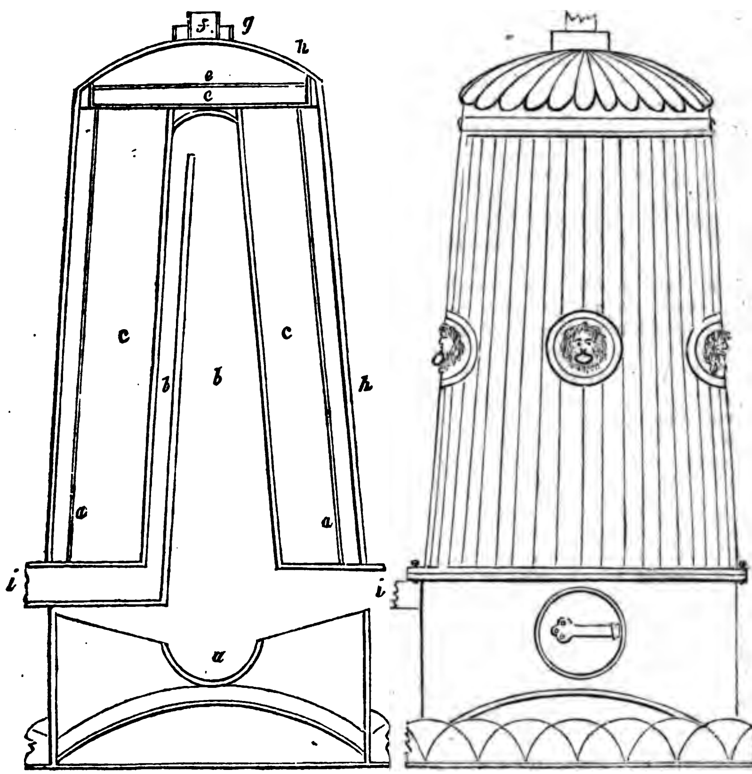
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 661. | SATURDAY, APRIL 9, 1836. | Price 3d.

HUTCHISON'S PATENT GAS-GENERATOR FOR THE USE OF SHIPPING.



HUTCHISON'S PATENT GAS-GENERATOR FOR THE USE OF SHIPPING.

In constructing this apparatus, it has been the object of the inventor to introduce a convenient and economical method of supplying a first-rate ship of war, or other large vessel, by one and the same process, with abundance of fuel, light, and heat.

Description:

a, is the furnace; *bb*, reverberating draughts; *cc*, retort; *aaa*, section of a cone formed of sheet-iron; *ee*, dry lime purifiers; *f*, gas-pipe; *g*, a hydraulic or sand-joint; *h*, a cast-iron cover; *i*, chimney. The coals from which the gas is to be extracted are placed in the retort. The distillation is effected by the action of the hot-air produced by the ignited coke in the furnace; this hot air, by traversing the passages shown by the arrows in the centre cone, distributes a uniform heat to every part of the retort. The gas, as it evolves, passes through the purifiers *ee*, and deposits all its impurities in the layers of lime spread upon the shelves.

It is likely to strike any one upon a first view of this machine, that a considerable addition to the usual cargo of coals would be necessary to its working on board ship; but the contrary is the case, as the same stock of coals, after having supplied gas for cooking and lighting, and diffused warmth through the vessel, will actually yield one-fourth more than its original quantity of coke: hence, there is a decided increase of fuel after having obtained from the coals the already enumerated advantages.

The saving which will result from adopting this contrivance in the Royal Navy and Merchant Service will be considerable, especially with respect to oil, candles, fire, wood, and coals.

The gas-generator appears to be peculiarly adapted to those vessels that trade to India and the Tropics, as it is well known that passengers (particularly invalids) are subjected to great inconvenience from alterations of temperature, which are frequent during such voyages. Those evils may now be, in a great measure, remedied, by regulating (through the supply-valve) the exact degree of warmth deemed necessary for the health and comfort of the passengers; and, by the same means, the gas in the galley, or caboose, can be immediately ignited, gradually reduced in quantity, or instantly extinguished; and these processes will create neither smoke, ashes, nor offensive vapour.

The gas may also be very effectively employed in making signals: the flame may be enlarged to any required dimensions, and, with a little care on the part of the attendant, it will exist in defiance of wind and rain. A powerful light to distinguish the admiral's ship is a matter of the utmost importance during war, or when a storm has dispersed a fleet.

A gas-light of sufficient size placed at the bows of the steamers employed on the Thames, would render the navigation of the crowded parts of the river much easier and safer, as it is well known that the majority of accidents which have happened of late years on the river, are to be attributed to the defective condition of the bow-lights. This apparatus will also be useful in cases of shipwreck in saving the lives of individuals.

Air and water-tight vessels constructed of caoutchouc and inflated with gas, will, by judiciously attaching them to the gunwale of a boat, effectually prevent her from swamping, and enable her to ride through the most tempestuous sea.

The apparatus occupies about three feet six inches square, and six feet in height.

To guard, hospital, convict, or prison ships, this machine will be exceedingly beneficial, both in respect to economy and comfort.

Light-houses may also by the same process be illuminated at half the present cost. To this latter application of his contrivance, and to a method of carrying on telegraphic communications during night, Mr. Hutchison has devoted much of his time; his attention is at present engaged upon the subject; and after he has matured his plans and calculations, the results of his investigations are to be laid before the public.

C.

London, March 11, 1836.

CORNWALL POLYTECHNIC SOCIETY.

We have before spoken of this Society in terms of high praise; and judging from the third Annual Report, which it has just issued, it has worked hard to make good its title to the rank we as-

signed to it of being one of the best, if not the very best of the institutions of its class. Agreeing, as we do, in a great measure with our correspondent P. P. C. R., (No. 660,) that the number of *permanent* Scientific Institutions and Museums is very small, we are the more delighted to observe the strong indications of lasting prosperity and usefulness evinced by our Cornish favourite. Patronised by the King, and having upon its roll of officers some of the first scientific names in the country, and others of the highest local influence, science cannot but continue to flourish under its protecting and fostering care; and more especially, while its managers continue to follow out the sensible plan of operations avowed in their present report.

"The principal cause to which your Committee would attribute the success of their past proceedings, and the quarter to which they would chiefly turn for hopeful encouragement in the prospect of the future, is the adaptation of the society to the tastes, habits, employments, and capabilities of the country. But for this, they durst not anticipate any thing beyond a brief and ephemeral popularity. No sustained and permanent result should be hoped for from any mere adventitious stimulas."

Cornwall, as all the world knows, was the nursery of the steam-engine. The vast quantity of water which had to be raised from its many valuable mines, in order to keep them in a workable state, prompted and rewarded the exertions of Savary, Newcomen, and Watt; and this district still claims a great superiority in its engines over every other. The reported results have, it is true, been received with incredulity in some quarters; and the alleged superiority has been stoutly questioned, if not absolutely denied. We have, for our own parts, however, no doubt whatever on the subject, and look upon the facts stated in the following brief historical summary, by Mr. Enys, as not only indisputably established, but quite scientifically accounted for:—

"The mode of estimating the performances of steam-engines, *by the number of lbs. lifted one foot high by the consumption of a bushel of coal,* was introduced into Cornwall by Watt, when it became requisite to keep a regular account of the work done and coal consumed, for the purpose of calculating his share, which was one-third of the saving of coal effected by his engine in comparison with Newcomen's.

"The performance of two atmospheric engines, at Poldice, had been ascertained as a standard of comparison, and declared by a Committee: for convenience the present dynamic unit was afterwards adopted, and the work done when thus expressed was equal to 7,037,800 lbs. lifted one foot high by each bushel of coal. A dispute arose in 1798 between Messrs. Boulton and Watt and the mining adventurers in Cornwall, and it became necessary to ascertain the average duty, which was proved to be 17,671,000 lbs.: this was rather less than in 1793, when the average of seventeen engines was 19,569,000 lbs. After the expiration of the patent in 1800, no accounts were kept of the work performed by the engines under the direction of the mining engineers.

"In August, 1812, the average duty of several engines on a month's trial proved to be only 13½ millions, and the truth of the prevailing opinion became apparent that less work was done than during Watt's patent. The present monthly report of 'work performed' was then established under the management of Mr. Lean, and since his decease has been conducted by his son, so that there exists a series of reports for twenty-two years, showing the duty for each month of the large engines employed in Cornwall, including the size of the pumps, and their depths, number of strokes, bushels of coal consumed, &c. &c.; a reference to which would point out at what period, and by whom, every increase of duty was obtained.

"Woolf introduced the use of high-pressure steam worked expansively in two cylinders, and first succeeded in performing fifty millions. Other engineers worked high steam expansively in one cylinder, which plan became general on the introduction of Trevithick's cylindrical boilers.

"Several engines now constantly perform a duty exceeding 70 millions, double that of the best of Watt's, and of which one has reached 91,200,000; another mentioned last meeting by our President, averages about 90,000,000; its best performance was 97,800,000, for one month.

"Part of the increase of duty must be attributed to the improved pitwork; the most rapid increase, however, took place on the introduction of a most complete system of *clothing*, the present practice of which is so efficient, that in two instances, though the steam in the *jacket* was at least 270°, the outside casing did not exceed 78°;—the thermometer was covered by a silk handkerchief to prevent the draught of air in the engine-house affecting the results;—the air outside was in one experiment 56°, and in the engine-house, about 66°;—the surface of the ashes over the boilers was about 90°."

The preceding extract is introductory to a set of tables, by Mr. Enys, "relative to the properties and practical application of steam, which are of such general interest, and calculated to be of such extensive utility, that we need make no apology for transferring them, along with some further preliminary remarks, to our pages.

"The simplest form of calculating the moving power of steam, is the extension to all pressures of the mode employed by Tredgold for the power of steam of atmospheric pressure. The term *efficiency* used in these tables, was suggested in a paper published in the Transactions of the Royal Society, in 1827, by Mr. Davies Gilbert: this word prevents confusion with engineer's power, or horse power, which is available efficiency, or the *neat* power of the engine applicable to the owner's use. It is equivalent to "*The power of steam to produce motion*" of Tredgold; "*The power exerted by steam*" of Wood on Railways; "*Mechanical power of steam.*" A similar distinction is also required between the *gross* work, including inertia, friction, &c., and the *neat* work done. *Effect* may be applied to the former; *Duty* to the latter.

"*Table* 1.

"The volumes of steam from one of water are from the tables by Clément Desormes. The efficiency is added, expressed in *lbs.* one foot high, or the force and space of the steam produced by the evaporation of a cubic foot of water.

"*Table* 2.

"Shews the common theory of the advantage of using steam expansively in a different form. The pressure of the steam is taken higher at each expansion, so as to produce an equal mean pressure in the cylinder, the steam being cut of at a fractional part of the cylinder to produce the required expansion; instead of the impracticable scheme of increasing the length of the cylinder at each expansion: this table assumes that pressure is inversely as the expansion, though not quite correct.

"*Table* 3.

"The first column gives the steam pressure due to the theory to produce a mean pressure of 16 *lbs.* per square inch in the cylinder. The table is calculated from the second column, in which the steam pressure is taken higher as a rough correction of the error of the assumption, when the temperature is diminished."

TABLE, No. 1.

Atmosphere.	Lbs. pressure per square inch.	Cubic feet of steam produced by the evaporation of one cubic foot of water.	Grains of water contained in one cubic foot of steam.	Temperature Fahrenheit.	Lbs. pressure per square foot.	Efficiency. (Force and Space.)
·125	1·8437	11801	37	124·6	265½	3133165
·25	3·6875	6198	70	150·8	531	3291138
·5	7·375	3229	135	179·6	1052	3329198
·725	11·0625	2217	197	197·6	1593	3531681
·1	14·75	1700	257	212·	2124	3610800
1·25	18·4375	1384	316	223·8	2655	3674520
1·5	22·125	1171	372	232·3	3186	3730806
1·75	25·8125	1016	430	242·7	3717	3776472
2·	29·5	899	486	250·7	4248	3818952
2·25	33·1875	808	541	257·9	4779	3861432
2·5	36·875	733	596	263·9	5310	3892230
2·75	40·5625	672	651	269·8	5861	3938592
3·	44·25	620	705	275·	6372	3950640
3·25	47·9375	676	759	279·8	6903	3976120
3·5	51·625	539	809	284·6	7434	4006926
3·75	55·125	506	864	288·8	7965	4030290
4·	59·	477	917	292·9	8496	4052592

TABLE 3.

Illustrative of the advantage of working High Steam expansively, as practised in Cornwall.

Steam pressure in lbs. per square inch due to the theory for the production of a mean of 16 lbs. per square inch pressure on the piston when expanded.	Assumed steam in per square inch, to produce, when expanded, a mean of 16 lbs. per square inch pressure on the piston.	Fractional part of the cylinder at which the steam is cut off.—Expansion inversely.	Temperature Fahrenheit.	Lbs. above atmosphere, per square inch on entering the cylinder.	No. of cubic feet of steam produced by the evaporation of one cubic foot of water = 62½ lbs. or 437500 grains.	Lbs. pressure per square foot on the piston on entering the cylinder.	Efficiency. Force and space. Gross power of steam produced from one cubic foot of water expressed in lbs. lifted one foot high.	No. of strokes made in a cylinder of the capacity of one cubic foot by the evaporation of one cubic foot of water.	Advantage (full stroke of 16 lbs. being taken as unity) of steam as assumed in tables, worked expansively.	Grains of water contained in each cubic foot of steam.	Quantity of steam in cubic feet required for each stroke in a cylinder of 360 cubic feet capacity.	Grains of water expended at each stroke respectively.	Lbs. pressure per square foot at the end of the stroke when expanded, divided from the first column.	Temperature of the steam Fahrenheit, when expanded below atmospheric pressure.	No. of cubic feet of steam produced by the evaporation of one cubic foot of water.	Lbs. pressure of the steam per square foot at the end of the stroke.	Efficiency. Force and space.	Grains of water contained in one cubic foot of steam.	Grains of water required at the end of the stroke in the cylinder, of 360 cubic feet.
	14·75		212		1700	2124	3610800			257									
	16		217	1·25	1587	2304	3656448	1587	1	275	360	99000	16						
	17		220	2·25	1417	2448	3664656	1906	1·131	292	270	78840	12·75	204	1930	1836	3543480	228	82080
17·18	18	2-5	223	3·25	1417	2592	3672864	2125	1·390	308	240	72920	12	199	2042	1728	3518576	214	77040
18·9	20	1-2	228	5·25	1284	2880	3698920	2568	1·751	340	180	61200	9·44	184	2560	1359	3479040	170	61200
22·96	24	1-3	239	9·25	1084	3456	3746424	3252	2·049	403	120	48360	7·62	179	3044	1097	3339468	143	51380
26·82	28	1-4	248	13·25	940	4032	3790080	3760	2·369	465	90	41850	6·72	176	3441	967	3327447	127	40220
30·66	32	1-5	254	17·25	850	4508	3831800	4250	2·696	514	72	37008	6·09	173	3791	877	3323797	116	41760
34·38	36	1-6	262	21·25	749	5184	3880816	4494	2·832	584	60	35040	5·73	171	3994	825	3295950	109	39240
38·08	40	1-7	269	25·25	683	5760	3934080	4781	3·001	641	51·43	32066	5·46	169	4191	786	3294526	104	37440
41·59	44	1-8	275	29·25	623	6336	3945328	4984	3·140	702	45	31590	5·19	166	4410	747	3294270	99	35640
45·06	48	1-9	379	33·25	571	6972	3981012	5139	3·238	766	40	30640	5	163	4573	720	3292560	95	34200
48·45	52	1-10	285	37·25	536	7488	4013568	5360	3·133	816	36	29376	4·85	160	4714	698	3290372	92	33120
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Columns referring to Steam, above atmosphere.													Columns to Steam, below ditto.						

SCOTCH.

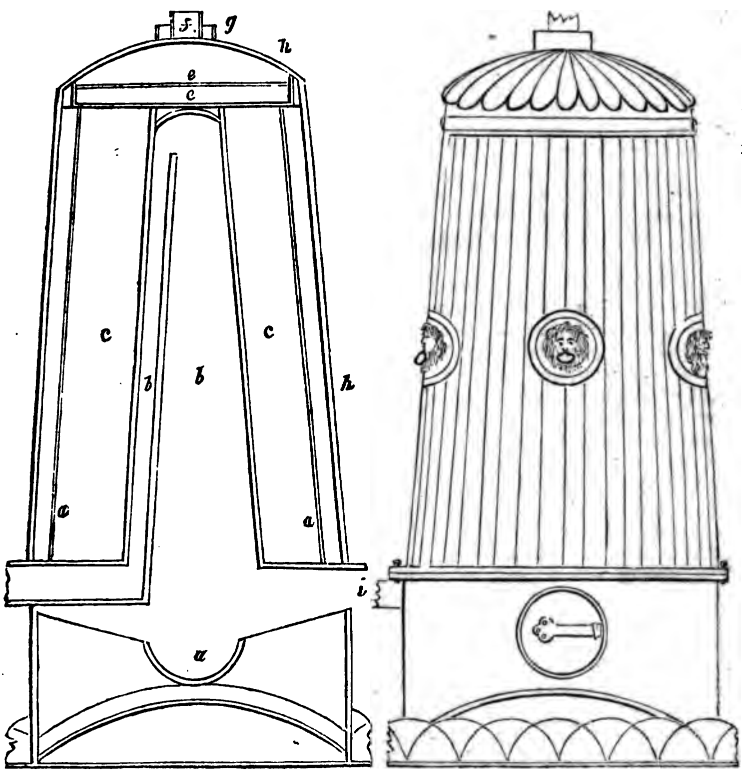
AMERICAN.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 661. SATURDAY, APRIL 9, 1836. Price 3d.

HUTCHISON'S PATENT GAS-GENERATOR FOR THE USE OF SHIPPING.



New-road, it could not be available for that purpose. Evidence was adduced to show that it would be a great advantage to trade and commerce to have a railway communication for goods and passengers extended to the City.

The amount of income expected to arise from the conveyance of passengers and goods is 113,559*l*., of which 90,818*l*. is expected from the conveyance of passengers, and 22,741*l*. from the conveyance of goods which are the manufactured articles of Birmingham, Manchester, and other manufacturing towns, and live and dead cattle to Smithfield, Newgate, and Farringdon markets.

The proposed railway is the extension and completion of the Birmingham Railway, and is an integral line between its respective termini.

The only line which can be considered as a competing one is an inclined plane, now in progress, from the Birmingham Railway at Camden Town to Euston-grove, a distance of nearly a mile; but that is only enabled to convey passengers and light parcels. The proposed railway has the advantage of conveying passengers to the centre of the metropolis, about three times that distance, yet at one-fourth less charge. It is also to be adapted for the conveyance of goods, which would otherwise have to be carted from Camden Town.

The whole line will be worked by locomotive engines, without any assistant or stationary power.

There seems to be no peculiar engineering difficulties in the proposed line.

There are no tunnels.

The steepest gradient is 1 in 273, or 19 feet in a mile. The smallest radius of a curve is half a mile.

The length of the line of railroad is two miles and fifty chains. There are no branches.

The plan seems, in an engineering point of view, well fitted for the objects intended.

No turnpike road will be crossed by the proposed railway on a level.

The estimated cost of the whole work, including the cost of property, is 600,000*l*. This estimate was proved by George Rennie, Esq., and supported by the evidence of Colonel Landmann, the engineer of the Greenwich Railway, as *respects the engineering* department; *and by George Smith*, Esq., and William Barnes, Esq., surveyors, in the city of London, as to the valuation of the property to be purchased. Your Committee, therefore, see no reason to apprehend it will be insufficient.

The estimated annual charge for the railroad, when completed, including all incidental expenses, is 40,000*l*., which was founded on the charges of similar works now completed.

The evidence fully satisfied your Committee that the return would be sufficient to support all the annual charges and maintenance of the railroad, and leave an adequate profit for the shareholders.

Your Committee think it desirable the House should be informed that, as this railroad follows the course of the River Fleet, a considerable portion of the ground is not built upon; so that, in fact, the arches under the railway will form as many dwellings as the railway will displace.

A great part of the houses that will be taken down in and about Hatton-garden and Saffron-hill are in a dilapidated and dangerous condition. Several parochial officers gave evidence as to the state of the neighbourhood, and the advantage it would be to have an opening made through that confined and unhealthy part of London.

THE PNEUMATIC RAILWAY.

Sir,—The peculiar formation of the air tubes which, in one way or other, are intended to form the carriage way of the projected pneumatic railway, appears to be that to which the attention of the public has been especially directed in the various articles which have appeared in the *Mechanics' Magazine* on this subject; but I am not aware that any thing bearing expressly on the mode of procuring the current of air in the tubes has been published. It seems intended that steam, applied through the instrumentality of stationary engines, should be the generator of power, and that this power should be employed to extract the air of the tubes through the agency of air-pumps. Have not some objections been made to this agency, raised upon the reciprocating action of the pumps, and the elastic nature of the element to be operated upon? If these objections have been thought formidable, might they not both be overcome by the simple application of fans instead of pumps, which are now

so generally employed for forming currents of air in many, nay in most of the cotton and other large manufactories throughout the kingdom? The injurious effect of the reciprocating action is by this simple apparatus completely done away with, and a constant and uniform action obtained in its place. The air in the tubes thus acted upon will be like a wire spring, continually on the stretch, and the evil effects which the elasticity of it produces when acted upon by an unsteady force would no longer exist.

It may be noticed that a fan thus employed may be made to act in a tube both ways, that is to say, in drawing the air one way and in forcing the air the opposite or any other way.

The application of this apparatus is so well understood, that any particular description of it would be superfluous.

Hoping that this may find a place in your useful miscellany,

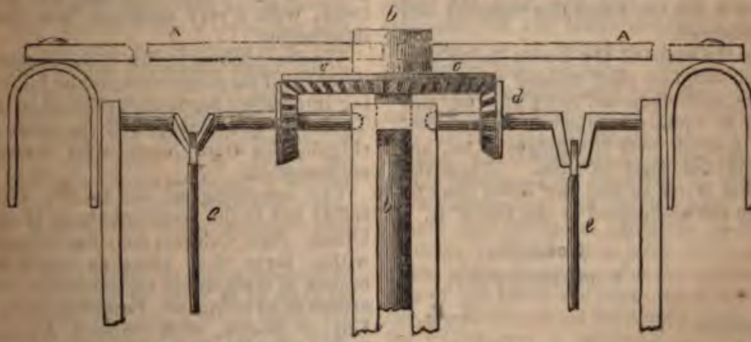
I remain, Sir,

Your obedient servant,

A. J.

Woodside, by Aberdeen, N.B.
March 18, 1836.

HORSE-WORKED FIRE ENGINE.



Sir,—It has always appeared inconsistent to me that horses when they can be employed should stand spectators, whilst men are perspiring and almost ready to sink with the fatigue of working. An illustration of this I witnessed lately at the lamentable fire in the Burlington Arcade, where horses were standing in groups idle, whilst the men were pumping the engines. Even this, however, would not be so bad were the power of the men advantageously employed; but the reverse is the case in the present method of working the fire-engine. There is nothing, perhaps, which seems capable of greater improvement; the present vertical method is almost the worst that could be adopted, as there is one point in the stroke at which there is scarcely any power available, I mean when the levers are horizontal, and consequently when the arms of all the persons working them are also in that position, in which they are least capable of exertion. It is not as if the persons on one side were at the dead point while the others were in full play, but both sides lose their power at the same time, and the only way they are enabled to go on is by the persons on the one side elevating themselves so as to have a downward thrust, and those on the opposite side stooping down so that they can push upwards. The levers always stop when they arrive at the horizontal position until the men on one side raise themselves, and the others stoop when they again go on; and on coming up again they stop at the same point. Sometimes, indeed, the men when fresh will work down and up without stopping at the centre, but this rarely continues for any length of time.

A plan has occurred to me for using the horses that drag the engines for working the pumps; a sketch of which I now send you.

A A are two wooden levers, which are put into the head of the spindle *b* in the manner of capstan bars; on this spindle is placed the bevel-wheel, *cc*, which works into the two smaller ones, *dd*; and on the shafts of these two smaller wheels are the cranks, which work the pumps by means of the connecting-rods, *e e.*

This is merely a first sketch, and is no doubt capable of many different arrangements.

Should it be objected to on account of occupying too much room, I am prepared to show in another paper the different measurements requisite, and also the length of levers necessary for producing the quantity of power which is at present requisite for working the fire-engine, also the sizes of the different wheels, &c., when I am quite sure this objection will be removed.

In the event of the horses being very much fatigued after coming a long distance, and others not being at hand, this plan is equally applicable to, and certainly much more advantageous for, applying the force of men. When the engine is not in use, the levers may be taken out and placed by the side of it.

I am, Sir,

Yours respectfully,

T. P.

Westminster.

THE ICE TRADE BETWEEN AMERICA AND INDIA.

(From the Asiatic Journal.)

The arrival of the Tuscany with a cargo of ice from America forms an epoch in the history of Calcutta worthy of commemoration, as a facetious friend remarked, in a medal of *frosted* silver. In the month of May last we received a present of some ice from Dr. Wise at Hugli, (whose efforts have been so long directed to the extension of its manufacture by the native process,) as a proof that the precious luxury might be preserved by careful husbandry until the season when its coolness was the most grateful, little did we then contemplate being able to return the compliment, with a solid lump of the clearest crystal ice at the conclusion of the rains! nor that we should be finally indebted to American enterprise for the realization of a pleasure for which we have so long envied our more fortunate countrymen in the upper provinces; nay, even the beggars of Bokhara, who in a climate at times more sultry than ours, according to Lieutenant Burnes, "purchase ice for their water, even while entreating the bounty of the passenger." Professor Leslie with his thousand glass exhausters, and his beautiful steam-air pumps, tantalized us with the hopes of a costly treat, and ruined poor Taylor, the bold adopter of his theory; but Science must in this new instance, as on many former occasions, confess herself vanquished or forestalled by the simple practical discovery, that a body of ice may be easily conveyed from one side of the globe to the other, crossing the line twice, with a very moderate loss from liquefaction.

We are indebted to Mr. J. J. Dixwell, the agent of the proprietors, for the following interesting particulars relative to the Tuscany's novel cargo, and the mode of shipping ice from America for foreign consumption.

The supplying of ice to the West Indies and to the southern states of the Union, New Orleans, &c., has become within these few years an entensive branch of trade under the successful exertions of its originator, Frederick Gudar, Esq., of Boston, with whom S. Austen, Esq., and Mr. W. C. Rogers, are associated in the present speculation.

The ponds from which the Boston ice is cut, are situated within ten miles of the city; it is also procured from the Kennebec and Penobscot rivers, in the state of Maine where it is deposited in ice-houses on the banks and shipped from thence to the capital. A peculiar machine is used to cut it from the ponds in blocks of two feet square, and from one foot to eighteen inches thick, varying according to the intensity of the season. If the winter does not prove severe enough to freeze the water to a convenient thickness, the square slabs are laid again over the sheet ice, until consolidated and so recut. The ice is stored in warehouses constructed for the purpose at Boston.

The shipping it to the West Indies, a voyage of ten or fifteen days, little precaution is used. The whole hold of the vessel is filled with it, having a lining of

tan, about four inches thick, upon the bottom and sides of the hold; and the top lifts covered with a layer of hay. The hatches are then closed, and are not allowed to be opened till the ice is ready to be discharged. It is usually measured for shipping, and each cord reckoned at three tons: a cubic foot weighs 58½lbs.

For the voyage to India, a much longer one than had been hitherto attempted, some additional precautions were deemed necessary for the preservation of the ice. The ice hold was an insulated house, extending from the after part of the forward hatch to the forward part of the after hatch, about fifty feet in length. It was constructed as follows:—a floor of one-inch deal planks was first laid down upon the dunnage at the bottom of the vessel; over this was strewed a layer, one foot thick of tan; that is, the refuse bark from the tanners' pits, thoroughly dried, which is found to be a very good and cheap non-conductor: over this was laid another deal planking, and the four sides of the ice hold were built up in exactly the same manner, insulated from the sides of the vessel. The pump, well, and main-mast, were boxed round in the same manner.

The cubes of the ice were then packed or built together so close as to leave no space between them, and to make the whole one solid mass: about 180 tons were thus stowed. On the top was pressed down closely a foot of hay, and the whole was shut up from access of air, with a deal planking one inch thick nailed upon the lower surface of the lower deck timbers; the space between the planks and deck being stuffed with tan.

On the surface of the ice, at two places, was introduced a kind of float, having a gauge rod passing through a stuffing-box in the cover; the object of which was to denote the gradual decrease of the ice, as it melted and subsided bodily.

The ice was shipped on the 6th and 7th of May, 1833, and discharged in Calcutta on the 13th, 14th, 15th, and 16th of September, making the voyage in four months and seven days. The amount of wastage could not be exactly ascertained from the sinking of the ice-gauge; because, on opening the chamber, it was found that the ice had melted between each block, and not from the exterior only, in the *manner of* one solid mass, as was anticipated. Calculating from the rods, and from the diminished draught of the ship, Mr. Dixwell estimated the loss on arrival at Diamond Harbour, to be fifty-five tons, six or eight tons more being lost during the passage up the river; and probably about twenty in landing. About one hundred tons, say three thousand maunds, were finally deposited in the ice-house on shore; a lower room in a house at Brightman's Ghaut; rapidly floored, and lined with planks for the occasion.

The sale has not, we believe, been so rapid as might have been expected, amounting to no more than ten maunds per diem, although Mr. Rogers has fixed the price at the low rate of four annas per seer, one half of the price estimated for the Hugli ice, which was calculated to be somewhat cheaper in proportion than saltpetre. The public requires to be habituated to it, and to be satisfied of the economy of its substitution for the long-established process of cooling. There may also be some doubts of the best mode of preserving so fleeting a commodity; but on this head we cannot but advise an imitation of the methods pursued on a large scale on board of the Tuscany. For the application of the ice to the purposes of cooling, ample directions have been given in the "Gleanings of Science," vol. iii. p. 120. A box or basket, or tin case, with several folds of blankets, or having a double case lined with paddy chaff, or any non-conducting substance, will preserve the ice until wanted; and for cooling water or wine, the most effectual method of all is to put a lump of the clear crystal into the liquid. The next best is to spread fragments upon the bottles laid horizontally, and have them wrapped in flannel for a couple of hours.

So effectual was the non-conducting power of the ice-house on board, that a thermometer placed on it did not differ perceptibly from one in the cabin. From the temperature of the water pumped out, and that of the air in the rim of the vessel, Mr. Dixwell ascertained that the temperature of the hold was not sensibly affected by the ice. Upon leaving the tropic, and running rapidly into higher latitudes, it retained its heat for some time; but after being several weeks in high latitudes, and becoming cooled

to the temperature of the external air and sea, it took more than ten days in the tropics before the hold was heated again to the tropical standard.

VENTILATION OF MINES.

Sir,—I have read the numerous important and interesting extracts in your valuable Magazine, from the evidence taken before the Parliamentary Committee, on accidents in mines, with some degree of attention; and perceive that the grand desideratum in the opinion of all parties examined, and others who have observed on the subject, is a better ventilation than has been hitherto effected.

I notice, too, that the air-pump has been tried, though in what manner has not been stated in the details I have seen, but evidently without any important result.

My present object is, therefore, now to suggest an application of the air-pump, in a manner which I think would be found to effect the object desired; viz. a complete ventilation of the most extensive mine.

The simplicity of my plan is such, that any person conversant with these matters will be immediately able to form a judgment of its practicability; and, although I have no practical knowledge of mining, I feel theoretically some degree of confidence that it will produce the desired effect.

My plan is this: on the top or the mouth of the shaft, over the most remote part of the mine, let a double-barrelled air-pump be erected, with a pipe of leather to descend to the bottom, and thence to that part which may be found contaminated with bad air. The end of the pipe, which may be eight or ten inches wide, should be left open, and kept distended throughout its whole length by small hoops at convenient distances. All apertures at the top of the shaft through which the pipe descends, should be closely stopped and made air-tight; and all others, wherever they may be found, except the principal shaft. By this means, when the pump is put in motion, the air in the immediate neighbourhood of the mouth of the pipe would necessarily be taken away through the pipe, and its place supplied by that surrounding it; and finally, the whole atmosphere of the mine would be put in motion, and supplied with pure air from the mouth of the great shaft of the pit.

A double-barrelled pump might be proportioned to the extent of the mine; say each cylinder to contain 30 gallons, which would take out one hogshead at every stroke of the engine; and supposing it made 40 strokes in one minute, it would remove 2,400 hogsheads of air in one hour. This would be sufficient to keep the atmosphere of the pit perfectly salubrious. I think the working of the pump a few hours a day would be sufficient for the purpose.

This contrivance is so simple, that it requires no further explanation; and if you will oblige me by giving it a place in your widely circulated Magazine, its merits, if it possess any, will soon be appreciated by those whom it may more immediately concern.

I am, Sir, respectfully,
Your obedient servant,
P. HALLIDAY.

Birmingham, March 28, 1836.

CIRCULATING DECIMALS.

Sir,—It appears to me a matter of surprise that none of your mathematical readers ever took notice (at least none have been published) of a question you inserted from me, in the 18th volume, respecting circulating decimals. I am the more persuaded that the subject is altogether new and original, from the fact that, in most cases, some one of your readers is ever ready, sometimes too ready, to correct the unfortunate wight who, in full anticipation of the honours due to an inventor, has communicated to your pages a new discovery of something which the aforesaid readers can prove, or at least attempt to prove, is as old as the hills.

The question is as follows: "Given $\cdot3488372 +$ a part of a decimal circulating series, required the whole of the series and its equivalent vulgar fraction."

The solution of this question depends upon, as I have before observed, one among several newly-discovered, or rather observed, properties of circulating decimals: some of these I noticed prior to, and others just after, the appearance of a communication on the

subject in your 9th volume from Mr. Utting, which was followed by some others, the most interesting of which was a notice of the late H. Goodwin, Esq.

The property to which I allude is, that every decimal circulate is formed by a continuity of combined geometrical progressions, of every ratio from two upwards to one less than the denominator of the portion from which the series is produced. A knowledge of one of these ratios, which I have named the circular multiplier, or ratio, enables us to form the series in the shortest possible space of time, and by what may appear singular, beginning at the end: thus to find the decimal circulate of $\frac{1}{29}$ put down unity on the right hand, and multiply it by 3 (the circular multiplier for this series); place the product unit figure on the left of the 1, then multiply it by 3; and again place the unit's figure of the product to the left of the former figure: continue to repeat this operation until the figures recur, and the result will be the decimal circulate $\frac{1}{29}$=·0344827586 2068965517241379331. To solve the given question, multiply the part given by 2, 3, 4, 5, &c., until among the products some of the given figures are found to be repeated: these will generally be combined with some of the unknown part of the series, which may therefore be united to the given part: this additional part being multiplied, will furnish more of the unknown figures of the series, and by continuing the operation the recurrence of the same figures will show where the series is completed. If unity be divided by five or six figures of the series, where it is decimally of the least value, the quotient will be the denominator of the fraction: this denominator multiplied by five or six of the given figures will give the numerator. In the present example, it will be found that when 3488372 is multiplied by 4 in the product 3953488, the first four figures are repeated, combined with 395. The part known will now be 3953488372: this, or rather the new part, multiplied by 4, adds three more figures to the series; viz. 581. Repeating the works we at last obtain ·348837209302325581395· for the whole of the series where ·0232 is of the least decimal value: therefore,

$$\frac{1}{\cdot 0232} = 43$$ gives the denominator of the series, and $\cdot 34883 \times 43 = 15$ gives the numerator; hence the equivalent fraction is $\frac{15}{43}$.

In many examples the work may be facilitated, and considerably abridged, by the assistance of some other properties, particularly that one noticed by Mr. H. Goodwin; viz. that every decimal circulating series has a complementary part.

Although I have no doubt that the ratio of the circumference and diameter cannot be expressed by any finite number to one, yet as the two, considered separately, are of finite dimensions, they must be capable of being expressed by two finite numbers, which two numbers are the numerator and the denominator of the fraction equivalent in value to the decimal series expressing the ratio; this decimal series is already known as far as 132 places of figures; hence it appears to me probable, that by some of the newly observed properties of decimal circulating series, the whole of the series may be found, and from it the vulgar fraction equivalent thereto. Since, however, the decimal circulate of a fraction, whose denominator is a prime number, may consist of as many digits as the number expressed by the denominator less 1, the immense number of figures in the series may present an almost insurmountable obstacle towards its attainment, without, however, affecting its possibility, if means can be devised for overcoming that difficulty.

Judging from what I have read upon the subject, it appears to have been very little studied, and if the attention of a few minds were directed to it, I feel assured that some very important results, as to the nature of the combination of numbers when multiplied by other numbers would be obtained, decimal numbers differing only from whole numbers in being decreasing instead of increasing series.

I am, Sir,

Yours respectfully,

ANTHONY PEACOCK.

January 20, 1836.

THE EXPERIMENTAL DATA REQUISITE TO DETERMINE THE LIMITS OF RAILWAY VELOCITY AND ECONOMY.

Sir,—Suppose it has been experimentally ascertained that a locomotive engine can pull a full load from a state of rest up an inclined plane, rising 1 in a foot, and that the resistance has been found to be $\frac{1}{b}$th part of the whole weight of the engine and train; then the pull exerted on the ascent will be to that on the level, as $\frac{1}{a} + \frac{1}{b} : \frac{1}{b} :: \frac{a+b}{ab} : \frac{a}{ab} :: a + b : a$.

Again, let us suppose that the engine and train had run a certain distance upon a level, so as to obtain a maximum speed, then if with this velocity they begin to ascend a plane of the above inclination, and if the steam could be brought up and maintained at such a pressure, that the pull exerted on the ascent should be to that on the level, as $a + b : a$, it would evidently follow that the initial velocity would be permanent during the whole ascent; but it is practically known that this is not the case: for it is now a well-established fact, that an engine cannot exert the same pull at high velocities as it could do at lower velocities; or, as Mr. Robert Stephenson says, "at high velocities the steam does not act so efficiently upon the pistons as at lower velocities." This being granted, it follows that although the steam is brought up to the same pressure in beginning the ascent (with the maximum velocity), as that which would be required to move the load up the ascent from a state of rest, the velocity in the first case will gradually decrease until it becomes uniform; and this last acquired permanent velocity will be equal to the full speed obtained when starting from a state of rest.

In both cases the power exerted by the engine is supposed to be the same. This being premised, let S be the length of the ascent in miles, V the initial velocity in miles per hour, and v the acquired permanent velocity, then $\frac{1}{2}(V + v)$ will be the average variable velocity per mile an hour, from the beginning of the ascent to the place where the velocity becomes uniform, and $\frac{1}{2}\left(\frac{1}{2}(V+v)+v\right) = \frac{V+3v}{4}$ will be the average velocity per mile an hour over the whole ascent; and $S \div \frac{V+3v}{4} = \frac{4S}{V+3v}$ will be the time in hours, or part of an hour, in moving up the whole ascent.

But to determine v, we must have recourse to an experiment, which, in this case, is easily done: suppose the time in moving up the ascent was observed to be h hours or part of an hour, then we have the equation $h = \frac{4S}{V+3v}$. From which $v = \frac{4S - Vh}{3h}$. Consequently $\frac{1}{2}(V+v) = \frac{2S + Vh}{3h}$.

Let us now inquire how far the engine and train will move up the ascent with a variable and decreasing velocity, or to the point where it becomes uniform?

Let x = distance; then $S - x$ will be the space gone over with the uniform velocity v; consequently $x \div \left(\frac{2S+Vh}{3h}\right) + (S - x) \div \left(\frac{4S - Vh}{3h}\right) = h$; from which equation we find $x = \frac{2S + Vh}{6}$.

Suppose an experiment had been made upon a plane rising 1 in 260 feet, length 6 miles, initial velocity 30 miles per hour, and the time in moving up the plane $16\frac{1}{2}$ minutes, or $\frac{11}{40}$th part of an hour; then $v = (24 - 8\frac{1}{4})\frac{40}{33} = 19\frac{1}{11}$ miles per hour, and $\frac{1}{2}(V + v) = \frac{1}{2}(30 + 19\frac{1}{11}) = 24\frac{6}{11}$ miles, average variable velocity per hour, and $x = \frac{2S + Vh}{6} = \frac{12 + 8\frac{1}{4}}{6} = 3\frac{3}{8}$ miles. From which it appears that the average variable velocity is $24\frac{6}{11}$ miles an hour; that the effect produced from the initial velocity ceases at the end of $3\frac{3}{8}$ miles, and that a permanent velocity of $19\frac{1}{11}$ miles per hour, then takes effect and continues to the top of the summit, and that when the engine and train start from a state of rest, the greatest velocity they can obtain will be $19\frac{1}{11}$ miles per hour.

If a few accurate experiments of this kind were made upon planes of different

inclinations with full loads, it would be easy to deduce from them accurate formulæ, that would be of far more importance than a cart load of such gossamer theorems as Mr. Herapath has thought proper to give.*

I am, Sir, yours, &c.
IVER M'IVER.

April 4, 1836.

SAFETY OF LEAD PIPES PROTECTED BY TIN.

(Extract of a letter from Mr. G. Chilton, dated New-York, June 23, 1834.)

Dear Sir,—Observing, in a late number, a notice of Ewbank's *patent* tinned lead pipes, and having had many applications for information concerning the danger attending the use of metal pipes for conveying water, beer, cider, &c., I have been induced to subject the pipes of Ewbank to a few trials, for the purpose of ascertaining whether, from the occasional contact of acids, any deleterious solution of lead would attend their ordinary use. It is well known, that the common beer pump, with a leaden pipe, has frequently given to the liquor a dangerous impregnation, especially after remaining stagnant for a time, and the beer in a sour state. The substitution of block tin would remove the apprehension of danger, but its greater price offers a strong temptation to the use of lead. It appears to me that the lead tube lined with tin will answer the ends of cheapness, safety, and durability. I would therefore invite your attention to the following experiments, which, if you think them of any importance to the public, you may insert in your Journal.

Experiments. — Various portions of lead tube, coated, some with pure tin, and others with different alloys of tin and lead, were bent into the form of a semi-circle, and filled with vinegar of different degrees of strength. After standing, some a month, and others six weeks, with occasional disturbance, the clear solutions were tested, first with sulphate of soda, and afterwards with bi-hydro-sulphuret of ammonia. The application of the first of these tests, namely sul. soda, produced no alteration in any of the solutions, from which it must be inferred that they contained no lead.

The application of the second test produced, as was anticipated, a brown precipitate of sulphuret of tin. In the same manner, two fresh pieces of tube were filled with a strong solution of common salt, which remained in contact for some time. The solutions when assayed with the same tests, showed that nothing but a little tin was dissolved.

It appears that in all these cases, which I regard as galvanic effects, the tin was the most oxidable metal, although, when not under the influence of polar arrangement and in the open air, lead appears to oxidiate sooner than tin. It is scarcely necessary to remind you that results similar to these were obtained thirty years ago by the celebrated Professor Proust, at Madrid, who undertook for the Spanish Government an extensive series of experiments on the different alloys of lead and tin, with the express view of determining whether the popular prejudices against the coating of copper vessels with an alloy of tin and lead, which is the common practice, was ill or well founded. Nothing can be more satisfactory than the conclusions he drew from his labours, namely, that as, in all his numerous experiments, neither lead nor copper were dissolved, there is little reason to fear the solution of lead from the tinning of our kitchen utensils. I may just mention here, that I am in the habit of cleaning out my soda fountain every spring with dilute muriatic acid, which uniformly dissolves the oxide of tin without touching the copper, which I am persuaded will remain as securely as the sheathing copper in Sir Humphry Davy's great experiment, and for the same reason. — *American Journal of Science and Arts.*

TUNNEL UNDER THE OHIO.

A writer in the *Cincinnati Journal* recommends the construction of a railroad under the Ohio river, opposite that city. The following is an outline of the plan:—

The railway is to consist of two semi-ellipses, one above and the other under-

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* I observe that this poorest of mathematicians, but most dogmatic and arrogant of all living prigs, has, after being beaten to his utter confusion and disgrace, in the controversy of his own provoking in the *Mechanics' Magazine*, started a Journal of his *own*, in order that he may have all his *own* way, and be no more troubled with such inconvenient antagonists as truth, honesty, and common-sense. I cordially wish him in his new character and career all the *success he deserves;* and beg, at *the same time, with equal cordiality,* to congratulate *the readers of the Mech. Mag.* on a capital riddance.—*I. M.*

neath. The height of the upper arch to be 10 feet, and the lower 3 feet, and 24 feet in width inside, making the ellipse 13 feet high and 24 feet wide in the clear. The arch to be composed of cut stone masonry 2 feet thick. This arch is to be buried in the ground just sufficient to protect it from the action of the river. A floor composed of timbers laid lengthwise, on the bottom of the arch, and covered with planks, forms the carriage-ways and side-walks. The carriage-ways to be each 8 feet wide, and the side-walks each 4 feet wide. The side-walks are a little raised above the carriage-ways. The stones composing the arch are to be cut so as to form segments of the ellipses, and laid in hydraulic cement, and made as near water-tight as practicable. Notwithstanding all the care that may be taken in the construction, yet with a pressure, in time of high water, of 4,375lbs. upon each square foot of the arch, the water will percolate through in such quantities as to require an engine to keep the road dry. It will of course be necessary to light the interior when opened for travel.

Between high and low water marks, there is a difference at this place of about 63 feet, and allowing the top of the arch to be 7 feet below low water in the bed of the river, and placing the bottom of the arch at each end, at high-water mark, will make the total descent 83 feet. It is thought that 1 foot ascent in 12 feet horizontal distance is the greatest inclination the road will admit; consequently, the length of the inclined arch, from high-water mark to the bed of the river, will be about 1,000 feet; and allowing also that the bed of the river at low water is about 1,000 feet wide, will make the total length of the road 3,000 feet.

The only difficult point in executing the work will be in excavating the earth and rock below low water. It is quite practicable, however, in a dry season, at comparatively small expense, to enclose a space with a frame of timber and plank, made water-tight by placing bags of earth around the outside, and pump out the water with an engine placed upon a flat boat, until theexcavation is completed and the arch formed within the space enclosed. Then by moving the *same coffer-dam its length* farther along, *another space can be enclosed*, and the *work completed in the* same manner, and repeated until the bed of the river is crossed. This part of the work will depend upon so many contingencies, that no accurate estimate can be made of the expense attending it. The masonry of the arch and the flooring can be estimated with tolerable accuracy. The stone for the work can be obtained 100 miles up the river, where extensive quarries are already opened. The cost of the masonry will be as follows:—

		dol. c.
Quarrying the stone per perch of 16½ cubic ft.		1 00
Delivering do. do.	do.	2 50
Cutting the same with three faces	do.	2 25
Mortar, of water, lime, and sand	do.	50
Laying the stone, including centering,	do.	75
Cost per perch		7 00
Every 10 feet in length of the arch will contain 78 perches of masonry, which, at *7d.* per perch, will be		546 00
Every 10 feet in length of the floor will contain 100 feet of timber, at 12½ cents per foot, 12*d*. 50*c*.—220 feet of plank at 3½ cents, 7*d*. 70*c*.		20 20
Total cost of 10 feet of the roadway....		563 20

Which being multiplied by 300, for the length, will give 169,860 dollars for the total cost of the arch and flooring. If to the above we add the probable cost of pumping the water and excavating the earth and rock for the roadway, and of covering the arch over again 3 feet deep, it will make the total expense not less than 210,000 dollars. To which should be added 20,000 dollars for superintendence and expenses of the affairs of the company, &c. There can be no doubt that the stock in such an undertaking will yield a handsome profit.

It will be observed that a roadway, constructed upon the above plan, leaves the river entirely unobstructed; that the arch is completely out of the reach of injury from the river; that it is permanent, solid, and will last for ever; and that it involves but a trifling expense to keep it in order for constant use.

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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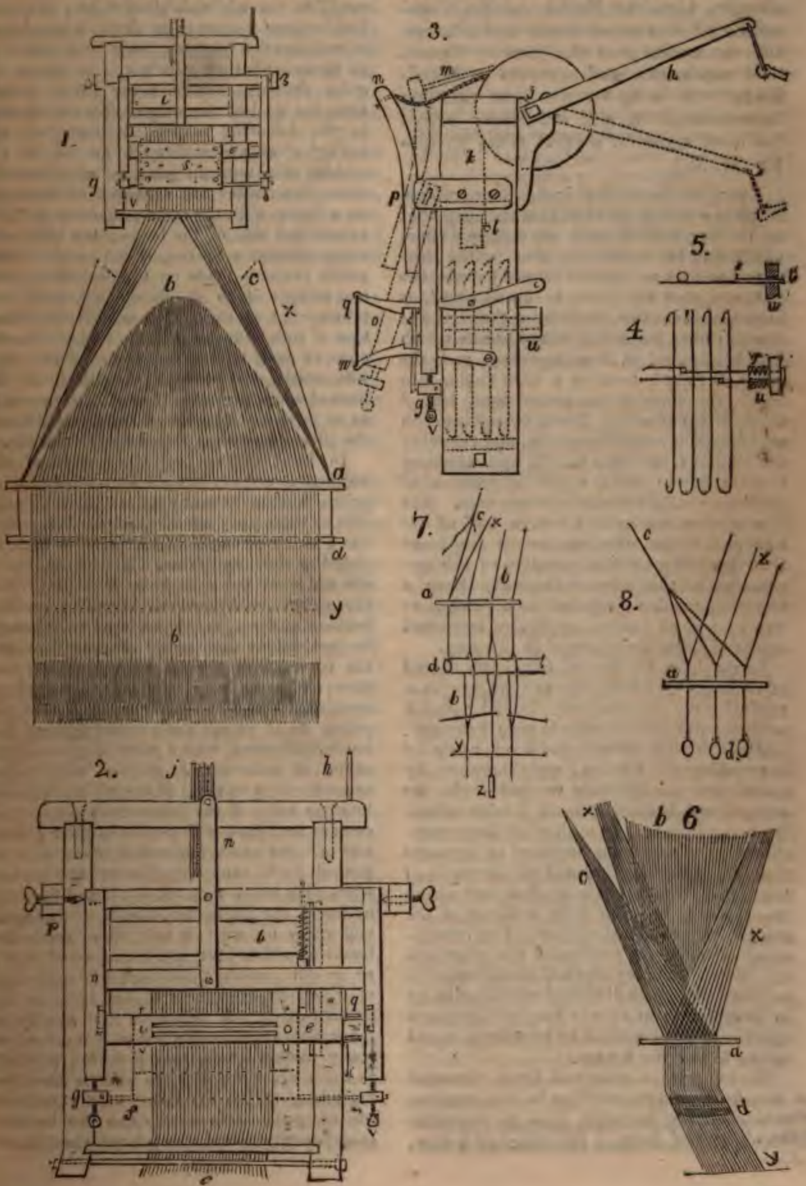
ROOKE'S IMPROVEMENTS IN THE JACQUARD LOOM.



ROOKE'S IMPROVEMENTS IN THE JACQUARD LOOM.

[We extract the following description of an important addition lately made to the Jacquard loom, from the last Part of the *Transactions of the Society of Arts*, and are glad (though not surprised) to observe, from the Preface of the Committee of Correspondence and Papers, that the author is of the class of "practical mechanics and weavers of Spitalfields." It is by far the most valuable improvement in silk machinery which has been made for several years past.—Ed. M. M.]

Every one knows that in the common loom for plain weaving, the threads of the *warp*, that is, the longitudinal ones, are arranged alternately into two equal sets; that by the raising of one set an angle is formed between the two, and that the *shoot*, or cross-thread, is introduced into this angle by a throw of the shuttle; that the set of warp-threads which was first raised is then depressed, and the other set raised, forming a fresh angle, into which the shoot is introduced by a second throw of the shuttle. Thus, by raising each set of warp-threads alternately, and throwing the shuttle from right to left, and returning it from left to right, a web is produced of perfectly similar texture in every part. But if a number greater or less than half of the warp-threads be raised at once, it is evident that this will produce a variation in the appearance of that part of the web. Such a variation regularly repeated is a pattern or figure; and all patterns or figures dependent on the weaving are produced in this way.

In the loom for figured silks every thread of the warp is passed through an eye in a vertical cord, to the bottom of which a leaden weight is attached, in order to keep it straight, and to bring the warp thread down again by overcoming the friction; and, therefore, by raising any one of these vertical cords, the warp-thread belonging to it is also raised. By tying together the cords of all those warp-threads that require to be raised at the same time, a single movement will lift the whole of them, and form an angle, or *shed*, into which the shoot is to be laid by a throw of the shuttle, as already described. For complicated patterns, the number of *ties* or groups into which the warp-threads are arranged is so great, that much difficulty was experienced in attaching them to any kind of apparatus capable of being worked by treadles actuated by the feet of the weaver.

M. Jacquard, a weaver of Lyons, invented a highly ingenious machine for this purpose, which, from the inventor, goes by the name of *the Jacquard loom*. He attached a wire, hooked at the end, to every set or group of cords, and arranged them vertically over a triangular bar, capable of being raised by the action of a treadle, and called the *lifting bar*, because, when in the act of being raised, it carries up with it all those cords or ties the hooks of which catch on the bar. But this, in the natural position of the hooked wires, would be the case with all of them; it therefore became necessary to devise some means of temporarily pushing back the hooks of all those cords that were not to be raised, in order that the others, being lifted, should form the shed of the warp. This is effected in the following manner: — Each of the hooked wires passes through an eye in the middle of a straight piece of wire, and all these latter wires are arranged horizontally on a frame with the ends projecting a little beyond one side of the frame; the other end abuts against a spring, which yields to any gentle pressure made on the projecting end, and returns it to its place again when that pressure is removed. It is evident, therefore, that if simultaneous pressure is made on the ends of some of the horizontal wires, they will recede, and carry back with them the hooked wires that pass through their eyes, so as to prevent these latter from catching on the lifting-bar when raised by the treadle.

In front of the projecting ends of the horizontal wires is hung a four-sided wooden prism, having as many holes bored in each side as there are projecting wires: this prism has a swinging motion, and turns a quarter round at each oscillation. Now, if this were the whole of the apparatus, it is plain that the prism could produce no effect on the horizontal wires, for the ends of them would be received at each swing of the prism into the corresponding holes of the prism, and thus all pressure on their ends would be avoided. But if we cover each face of the prism, as it swings successively against the horizontal wires, with a piece of pasteboard, called a *pattern-card*, pierced with holes, corresponding to those of the prism, opposite to some only of the horizontal wires, it is evident that these will remain in their places, and all the other horizontal wires will be pushed back, thus withdrawing the hooked wires with which they are connected from the action of the lifting-bar, which, when raised, will carry up with it only those cords the hooks of which have not been pushed back; or, in other words, those the horizontal wires of which were opposite to the holes in the pattern-card. A throw of the shuttle is made after every oscillation of the prism: as many pattern-cards, therefore, are required as there are throws of the shuttle from the beginning to the repetition of the pattern, including the plain part which lies between such repetition, and also between the different

portions of the pattern itself. In patterns of no uncommon extent, the number of cards required is 1700 or 1800, nearly half of which are repetitions of a very few being wanted for the plain work alone.

In vol. xl. of the Society's Transactions is a description of the old loom, with an improved draw-boy by which the figure or pattern was determined. In vol. xlvii. will be found Mr. Hughes's improvement on the Jacquard loom, by which one set of cards is made to hold two patterns; and in vol. xlviii. is Mr. Jennings's improvement of the Jacquard machine, and also a simplified machine by Mr. Dean.

Mr. Rooke's improvement relieves the band from all the repeating cards which form the ground, and causes their work to be done from a second treadle; thus easing the weaver by the more equal use of his legs on two treadles, and saving a considerable expense and bulk of cards.

For this purpose Mr. Rooke constructs a very small Jacquard machine, and places it at the back of the larger one, and at *right angles* to it, and this is wor7ed by a treadle at the other foot. With this small machine he uses a little band, containing no more cards than there are variations in those repetitions of which the great band of cards is thus relieved.

Fig. 1 is a view of the small machine taken from the back of the loom; consequently, if the whole loom was shown, the larger machine would be seen behind this.

a a is the compass-board, *b b* the usual lifting cords from the large machine *x x*. Mr. Rooke's additional lifting or binding-cords proceed in twenty-four pairs from the large machine to the twenty-four shafts *d d*, and *c c* are the lifting-cords from his small machine which proceed in eight pairs to the same twenty-four shafts: these being sixteen in number, form eight pairs; each pair is divided into three; these three join three of the cords *x x x*, and go to the ends of three shafts *d d*, as shown in fig. 8: so three are lifted together by the small machine, there being twenty-four shafts and only eight changes: these threes are used for a satin ground: when other grounds are to be formed, the shafts are arranged so that two or only one may be lifted by each pair of cords from the small machine, the small band in that case containing a suitable increase of cards: the holes in these cards are always in pairs, in order the better to lift the shafts at each end. *e* is the revolving bar, *f* the band of eight cards upon it, corresponding with the eight pairs of lifting cords: they are kept conveniently extended by a light rod *g g*, so as to revolve very correctly with the bar *e*.

Fig. 2 is a larger view of the small machine, *and fig. 3 a side view*. *h* is the lever by which it is moved: if this were long enough to pass the large machine, the treadle would not give it sufficient motion; therefore it is met by another lever *i*, which receives motion from the treadle behind the weaver. The lever *h* turns the pulley *j*; this by a cord *k* raises up the lifting-frame *l*, shown only by dotted lines in fig. 3. When this has taken up the proper hooks, the string *m* becomes tight enough to pull in the top of the batten *n*; this protrudes the batten-frame *o o*, which hangs on centres *p p*, and also causes the bar *e* to revolve by the hook *q* retaining one corner of the bar whilst the rest is being carried out, and thus causes a quarter turn: a spring attached to the frame *o* pulls it back again quite close as soon as the treadle is suffered to rise, and presses the next card against the needles, the blanks pushing in those needles whose hooks are not to be raised. These machines are made with single, double, or quadruple rows of lifting-hooks according to their work. Fig. 1 has but sixteen hooks, and all in one row; fig. 2 has twenty-six in a row; and fig. 3 shows four such rows, forming what is called a short one-hundred machine.

In the machines formerly described, each of the four sides of the revolving-bars was bored with as many holes as there were needles, and in as many rows as there were rows of hooks. Mr. Rooke, instead of forming each row of distinct holes, cuts a continued groove in the prism, of the same depth as the holes, whereby he obtains increased facility in adjusting the pattern-card to the ends of the needles, and spares the care that otherwise would be required to keep the holes strictly equidistant.

In fig. 1, the bar *e* has but one groove on each side; in fig. 2, two grooves are shown; whilst to make it suit fig. 3, four such grooves would be required. The lifting-frame *l l* slides as usual in grooves within the outer frame; in fig. 3, the bars are seen by dotted lines just under the hooks they have to lift. In fig. 4, four hooks are shown, and only two of the needles; *r r* are the springs that protrude the ends of the needles towards the bar *e*; fig. 5 is a top view of one needle, *s* is the bend against which the spring *r* acts; a small wire passes through the bend *t*, which prevents the needles from ever being pushed too far by the springs *r*, and confines them to the bar *u*. *v v*, figs. 1, 2, and 3, are screws to adjust the revolving-bar *e* correctly to the needles; nuts *g g* are also placed on them, through which the rod *g* passes to extend the band of cards; these enable the rod to be adjusted to the exact height. The end adjustment of the revolving-bar *e* is given by the screw-centres *p p*. The lower hook *w* is merely to cause a return of the band of cards, and thus undo the work, should any accident

require it. To effect this, a string from the tail of hook q lifts it out of contact with the revolving-bar, and at the same time brings the hook w in contact with it by means of the wire $q\,w$, which connects the two hooks: this causes the bar to revolve in the contrary direction, merely by the same action of the treadle as would be required for going on with the work, and thus, by reversing the motion of the cards, enables the workman to unravel till he arrives at the part where any error has been committed.

This monture, as before stated, contains twenty-four shafts $d\,d$, connected in threes to the small machine by eight pairs of binding or lifting-cords $c\,c$. These twenty-four shafts have all the warp attached to them, and are also all connected to the larger machine, not in sets, but singly by twenty-four pairs of binding-cords $x\,x\,x$: thus either machine will lift the shafts, so that there are three ways by which the warp can be raised; first, by the shafts and small machine, in eight portions; secondly, by the shafts and large machine, in twenty-four portions; and, lastly, by the large machine, in the usual variable portions, without the shafts.

The holes in the cards, and the hooks by which the large machine lifts the shafts, are purposely placed outside the other sets, the better to distribute them in pairs, and also to keep the weight equal on the lifting-frame l.

Fig. 6 is a side view with respect to the loom, and an end view of the compass-board: it shows the twenty-four pairs of lifting-cords $x\,x$ divided, one half to the right and the other to the left, so as to be lifted by hooks at each end of the frame b. $c\,c$ are the lifting-cords from the small machine: here one half is hid behind the other, the hidden part proceeding to the other end of the compass-board (as shown in fig. 1); the dots at the lower c show where they divide into three—of course, the higher they are divided the less will be the divergence of the cords—they then are joined to the cords $x\,x$, just above the compass-board a, as seen in fig. 8. $d\,d$ shows the ends of the twenty-four shafts, and $y\,y$ the warp. b shows the usual lifting-cords from the Jacquard machine placed between the additional ones. Fig. 7 shows two lifting-cords x and c proceeding from the two machines towards the compass-board, just above which they join, and then pass through to the end of a shaft d. $b\,b\,b$ show three of the usual lifting-strings, one up, the others down; they have loops $b\,b$ through which the shaft passes, so that they can go up singly like the one shown raised, but when either machine lifts a shaft it takes all up together.

In this machine, when a figure of one colour is worked on a ground of one other colour, the two treadles are alternately used; if the figure has two colours, the treadle of the large machine will be used twice to the other one; if four colours, then they will be used as four to one. When any colour goes off the pattern, a bell rings; and when all the colours are off, the small machine only is used to work the ground. In fig. 1, $y\,y$ shows the place of the warp; $z\,z$ are the weights.

ON TUNING—NEW MATHEMATICAL DIVISION OF THE SCALE.

Sir,—The following is a mathematical division of the scale, assuming the bass C as 30 inches:—

C	30.
C *sharp*	$28\frac{5508}{59049}$.
D	$26\frac{39366}{59049}$.
D *sharp*	$24\frac{51008}{59049}$.
E	$23\frac{41553}{59049}$.
F	$22\frac{11642}{59049}$.
F *sharp*	$21\frac{4131}{59049}$.
G	20.
G *sharp*	$18\frac{43038}{59049}$.
A	$17\frac{45927}{59049}$.
A *sharp*	$16\frac{38256}{59049}$.
B	$15\frac{15975}{59049}$.
C	15.

It is obtained thus:—

$\frac{2}{3}$ of 30	$= 20$	G above.
$\frac{2}{3} - 20$	$= 13\frac{1}{3}$	$\times$ 2 D.
$\frac{2}{3} - 13\frac{1}{3}$	$= 8\frac{8}{9}$	$\times$ 2 A.
$\frac{2}{3} - 8\frac{8}{9}$	$= 5\frac{25}{27}$	$\times$ 4 E.
$\frac{2}{3} - 5\frac{25}{27}$	$= 3\frac{77}{81}$	$\times$ 4 B.
$\frac{2}{3} - 3\frac{77}{81}$	$= 2\frac{154}{243}$	$\times$ 8 F *sharp*.
$\frac{2}{3} - 2\frac{154}{243}$	$= 1\frac{551}{729}$	$\times$ 16 C *sharp*.
$\frac{2}{3} - 1\frac{551}{729}$	$= 1\frac{373}{2187}$	$\times$ 16 G *sharp*.
$\frac{2}{3} - 1\frac{373}{2187}$	$= \frac{5120}{6561}$	$\times$ 32 D *sharp*.
$\frac{2}{3} - \frac{5120}{6561}$	$= \frac{10240}{19683}$	$\times$ 32 A *sharp*.
$\frac{2}{3} - \frac{10240}{19683}$	$= \frac{20480}{59049}$	$\times$ 64 F.

These multipliers are not arbitrary numbers, but as the second stage brings us beyond the first octave, we must double it to bring it within the octave; and as the fourth stage brings us beyond the second octave, it must be twice doubled (or quadrupled), and so on of the rest.

A piano-forte tuned according to this scale would, I think, have a very pleasing effect; but, independent of the impossibility of tuning to that exactness, piano-forte-makers, instead of doubling the length of string to produce the sound of

the octave below, *must necessarily* use a thicker wire, or we should have piano-fortes as large as houses.

The following is Earl Stanhope's scale:—

C—C, perfect octave.
C—G, perfect fifth.
C—E, perfect third.
E—B, perfect fifth.
C—F, perfect fifth.
F—B *flat*, perfect fifth.
E—A *flat*, bi-equal third.*
A *flat*—C, bi-equal third.
A *flat*—E *flat*, perfect fifth.
A *flat*—D *flat*, perfect fifth.
D *flat*—G *flat*, perfect fifth.
G—D, D—A, A—E, three tri-equal fifths.†

These tri-equal fifths, though flat, are not of such a degree of flatness as to be offensive to the ear; differing from a perfect fifth only 829,885 parts in 300,000,000, or $\frac{829885}{300000000}$. If this interval G—E, as in Kirnberger's method, be divided into one perfect fifth, and two equally flat fifths—such, for instance, as the perfect fifth G—D, and the equally flat fifths D—A and A—E; then each of these two last fifths, by becoming too flat, is offensive to the ear. And if that same interval be divided into two perfect fifths, and one flat fifth, then this flat fifth so produced is still more offensive.

In tuning each key throughout the whole instrument, too much attention cannot be paid to the beatings, as that is by far the most accurate way of tuning by the ear. For, whenever a third, fourth, fifth, sixth, or octave, is quite perfect, there is no beating to be heard. But, on the contrary, when any of them are in any degree imperfect, though not distant from perfection, a beating is always audible. A very slow beating proves that the distance from perfection is not great; but as the beating becomes quicker, the distance from perfection becomes more considerable, and, from the equality of the beatings, *equal deviations* may in like manner be correctly ascertained.

Some tuners, in order to assist the fifths, have proposed to tune the octaves a little imperfect. The objections to this are obvious, for if we *sharpen* the octaves to assist the fifths, it injures the thirds; and if we *flatten* the octaves to assist the thirds, it injures the fifths. Such is the construction of the human ear, that we can bear a much greater deviation from perfection in the fifths than we can in the octaves, and a still greater deviation in thirds than either the fifths or octaves. Again, however small the deviation may be in a single octave, it becomes very sensible in two or three, and most offensive in six or seven.

We have been in the habit of considering the Wolf as an inherent imperfection in every instrument that has exactly twelve fixed keys in each septave; whereas, so far from being an imperfection, it is precisely the proper distribution of it that produces that charming variety of character between the different keys, which is so essentially requisite in a well-tuned instrument.

CORIO.

April 8, 1836.

* A bi-equal third is thus obtained:—from one perfect octave deduct one perfect third, and divide the remainder into two equally sharp thirds.

† A tri-equal fifth is thus obtained:—divide the interval included by a perfect fifth from the key-note, and the second perfect octave above the perfect third from the same key-note, into three equally flat fifths, which are tri-equal fifths.

WIDENING OF BLACKFRIARS' BRIDGE.

Sir,—In Alderman Wood's recently published proposed metropolitan improvements, two of the suggested new streets terminate at Blackfriars' Bridge, and others tend towards the same point. But the question has not been considered—Has this bridge capacity for the increased traffic that would thus be attracted to it; and is it not, on the contrary, barely sufficient for the present? If it be found that the bridge is too confined, can it be adapted to meet the probable increase of traffic? These are questions that appear to me to claim the consideration of the public at a time when large sums are being expended on the repairs of the bridge, without any improvement in the roadway, either by reducing the steep ascent or giving a greater width. The accidents constantly occurring in consequence of the dangerous acclivities, will probably *force* the authorities to reduce them; but the *widening* question is not in this position. The point, however, is too important to be lost sight of. I have stepped the width of the bridge, which is about 40 feet, "more or less." London Bridge, by the same mode of measurement, I made about 50 feet, the traffic

on which is, of course, greater; yet the difference in facility of passage is as great as between Old London Bridge (which, by-the-bye, did not differ greatly in width from Blackfriars), and its nobly proportioned successor, the present London Bridge. How much did the City of London consent to pay for even an additional four or five feet to the width of the last-mentioned bridge? And it is rumoured that an increase of double that extent is practicable on Blackfriars at a comparatively trifling sum, not more, as I have heard, than a small per centage of the money now being expended on repairs, ***substantial repairs***, I admit; but yet ***only*** repairs, not ***improvements***, as respects the public convenience.

I am, Sir,
Your most obedient servant,
A CITIZEN.

Fleet-street, February, 1836.

METHOD OF MAKING CAPILLARY TUBES IN METAL.

For gas-burners, for the safe combustion of mixtures of oxygen and hydrogen, and for other purposes, it is often desirable to divide the end of the discharge-pipe into fine capillary tubes, of the depth of half an inch or more. It is difficult and expensive to bore such apertures in a piece of solid metal, and it is hardly possible to be executed at all, if the apertures are required to be of very small diameter.

Two new methods of producing such capillary tubes have been communicated to the Society of Arts—one by Mr. J. Roberts, of Queen-street, Cheapside, and the other by Mr. Henry Wilkinson, of Pall Mall—which are thus described in the last Part of the Society's Transactions :—

Mr. Roberts's Method.

"Mr. Roberts very ingeniously and expeditiously subdivides the end of a metal pipe into small tubes of any required depth, by means of pinion-wire. Pinion-wire is made by taking a cylindrical wire of soft steel, and passing it through a draw-plate of such a figure as to form on its surface deep grooves in the direction of radii to the axis of the wire: the ribs which separate these grooves from one another may be considered as leaves or teeth, and of such wire, when cut into proper lengths, are made the pinions used by watchmakers. Hence arises the name by which this wire is commonly known. If now a piece of this wire be driven into the end of a brass pipe of such a size as to make a close fit with it, it is evident that that part of the pipe has thus been subdivided into as many smaller tubes as there are grooves in the wire. By using a draw-plate fitted to make smaller and shallower and more numerous grooves than are required in common pinion-wire, it is manifest that wires or cores may be produced, which, when driven into metal pipes, as already described, will subdivide them into capillary tubes of almost any degree of tenuity."

Mr. Wilkinson's Method.

"In the course of some experiments on artificial light, which I was engaged in about twelve months since, I was desirous of obtaining a great number of extremely minute apertures for a gas-burner; and, finding it impossible, in the ordinary way, to obtain them, a new method occurred to me, which immediately produced the desired effect. I showed it at the time to several eminent scientific men, who were unable to conceive how these apertures were formed; and, as I made no secret of the method, they were equally pleased at the simplicity of the operation; and the specimen herewith sent has been exhibiting at the Gallery of Practical Science for several months. I did not attach much importance to it myself; but, as I do not find that it is at all known, and now think it might be useful in a variety of ways, I have sent it for you to lay before the Society; and should they be of the same opinion, I shall feel much pleasure in communicating the mode of operation, by which any number of apertures, hardly visible to the naked eye, and of any length (*even a foot, if required*) may be made in any metal in *ten minutes!*

"The process consists merely in turning one cylinder to fit another very accurately, and then, by milling the outside of the inner cylinder with a straight milling-tool of the required degree of fineness, and afterwards sliding the milled cylinder within the other, apertures are produced perfectly distinct, and of course of the same length as the milled cylinder. A similar effect may be produced on flat surfaces, if required."

BOOT AND SHOE STUDS.

Sir,—About six years ago, an invention of a kind of iron studs, for increasing the durability of the soles of boots, made a great stir in the town; but its merits could but have been very imperfectly known when the manufactory in Giltspur-street was suddenly closed, and I have not been able to find that the "powerful machinery," which was said to be employed in the process, has been,

any where, subsequently brought into operation. I have just parted from the last pair of boots which I had made on this principle—not because they were actually worn out, but in consequence of their having become out of fashion.

The proprietor, or patentee, of this truly useful invention, as near as I can recollect, was a gentleman of some eminence in the legal profession, of the name of "Arabin," or "Espinasse," whose demise, if it deprived not the public of the benefit of clergy, certainly occasioned a lamentable vacancy in the cure of soles!

My object in addressing you, Mr. Editor, is to excite the attention of those whom it may concern to the practicable revival of a contrivance so admirably calculated to maintain a respectable footing in society, and to carry us above the dirty ways of the world.

I am, sincerely, Sir,
Your most obedient servant,
HENRY BRETT.

Old Furnival's Hotel, March 25, 1830.

PORCELAIN SCALE-PLATE.

Mr. Juggins (of James-street, Covent Garden) is a dealer in butter and cheese. He states that in weighing the former it is the practice to wet the metal dish at present in use, in order to prevent the butter from adhering to it: the true weight of the butter is, therefore, less than the apparent by all the water that is put on the dish; a circumstance that, in weighing out butter by the ounce to small customers, amounts to a very sensible proportion of the whole weight.

It is also necessary, especially in hot weather, to scour the scale-dish two or three times a day, both for the appearance of cleanliness and to prevent the scale from giving a taint to the butter placed on it. But this frequent scouring makes the scale-dish too light, and, in order to adjust the scales, there is a constant temptation to employ contrivances which subject them to be broken when examined by the Annoyance Jury.

For the last five years Mr. Juggins has employed a plate of glazed porcelain instead of metal, by which he obtains the advantage of constant cleanliness, without the necessity of wetting the surface of the plate before using it: there is no sensible loss of weight, for this plate never requires to be scoured, but only to be washed or wiped; the butter receives no taint, and the evident cleanliness conciliates the good will of customers. The cost of one of these plates, on account of its size and thickness, is seven shillings and sixpence; but Mr. J. has not hitherto had any broken, so that with common care they will seldom require to be renewed.—*Trans. Soc. of Arts.*

VEGETABLE OILS.

(From Report of the Commissioners of Excise Inquiry.)

Customs' Duties on the Raw Materials.

Although the instructions contained in our commission do not lead us to the examination of the Customs' duties on the raw materials employed in the manufacture of soap, we trust that we shall not be considered as exceeding the proper line of our duty by calling attention to the remarks of the deputation, as well as of Mr. Fincham and Mr. Taylor, as also of Mr. Tennant of Glasgow, upon the great disadvantages to which the manufacturer is exposed from the heavy duties on importation, to which the *vegetable oils* are still liable. These oils would enter largely into the composition of soap, if their price were not so much increased by these duties, which amount on some descriptions to a virtual prohibition of their use. The French, at Marseilles, employ olive oil exclusively in their soap; and in that town alone a quantity is made very nearly equalling the consumption of Great Britain. According to Mr. Tennant, the soap made from olive oil is better than that which is made from palm oil; and if the present duty of 4*l.* 4*s.* per ton on the former could be materially reduced, there seems to be every probability that after the abolition of the present restrictions on the manufacture, such improvements would be introduced as would enable us to rival, and probably to surpass, the French in the North American market. Our manufactures are now placed in so disadvantageous a situation as compared with the French and other makers, that it is very difficult for them to contend with them in the foreign markets; and even if the restrictions imposed by the Excise on the process of manufacture were removed, they would still suffer considerably from the duties on the materials which they employ, and on which no drawback is allowed; and it must be remembered that the difficulties under which the trade labour on this account have been materially increased by the discontinuance of the allowance of the tenths, to which we have already alluded.

The representations which were made to us on this head appeared to be so much de-

serving of attention, that we were induced to request the attendance of Mr. Crawfurd (the late resident at Singapore, and the author of a valuable work on the Indian Archipelago), for the purpose of obtaining such information as he could furnish with respect to the supply of those vegetable oils which might be obtained from the East Indies. Mr. Crawfurd appears to have directed his attention, during a long residence in India, very closely to the productions of that country, with a view of extending its commerce with Great Britain, and it will be seen from his evidence, that a very large field may be opened for a mutual trade, especially with reference to the articles more particularly wanted for the manufacture of soap. He states, that there are no less than fifteen *plants* in ordinary cultivation, in the continent and islands of India, from which an abundant supply of oil is obtained for the purposes of food and light; and he adds, that from the general facility with which this cultivation may be extended, he sees no limits to the quantity which may be furnished for the demands of this country. He particularly points out the advantage which may be derived from the cultivation of the Palma Christi, or castor-oil plant, which grows in any soil, however barren, and yields a most abudant crop of oil.

* * * *

The present rate of duty on castor-oil, sesamum, cocoa-nut, palm-oil, poppy-oil, mustard, and pig-nut oil, and the amount received for the last five years, will be found in the appendix. The *ad valorem* duty on pig-nuts, sesamum, and poppy-seed, and on the oil made from them, is so high (viz. 20 and 50 per cent.), as to amount to a virtual prohibition of their extensive employment in any branch of manufacture. The duty on castor-oil "from any British possession, but not the produce thereof," is also so high as to prevent its use in manufactures. We are aware of the reductions which have been lately made in the duties on some of the vegetable oils; but it has been almost impossible for the manufacturers to avail themselves of these reductions, on account of the Excise regulations. When these are removed, we anticipate the best effects from these reductions.

Our other trades and manufactures, the materials of which are subject to import duties, are not so much injured by them as to deprive us of the means of carrying on a profitable competition in foreign markets. But our inferiority in the manufacture of soap, in so far as it arises from the duties on oils, gives the foreign manufacturer the power of excluding us from large portions of the globe, and this certainly is a state of things from which so important a manufacture ought to be relieved. We feel it to be our duty not to lose this opportunity of again representing the strong impression which has so often been made upon us by the consequences of the impolicy of taxing the raw materials of industry, because we are fully satisfied that our commercial and manufacturing prosperity, great as it is, would be still more increased if the principle of exempting all raw materials from taxation were strictly adhered to. Whatever the loss of revenue might be which would take place in consequence of repealing these duties, it would soon be made good by the additional means of payment which would follow from increased national wealth.

PROVINCIAL MUSEUMS AND INSTITUTIONS.

Sir,—I beg to transmit to you the *form* of a petition to Parliament on a subject lately noticed in your Magazine, in the hope that it may prove serviceable to these useful establishments. At a future opportunity I intend to offer to your readers a list of the permanent and public district institutions in the United Kingdom.*

I am, Sir,
Your obedient servant,
S. S.

To the Honourable the Commons of the United Kingdom of Great Britain and Ireland in Parliament assembled.

The Humble Petition of the undersigned Managers of the ———,

Showeth,—That your petitioners beg to express their gratification at the appointment of a Committee of your Honourable House to inquire into the condition, management, and affairs of the British Museum, hailing it as a promise of the future extension of the usefulness of that national institution.

That your petitioners have reason to believe that the British Museum is, at present, possessed of many duplicate printed books, coins, prints, objects of natural history, and other curiosities; and that such duplicates are likely to continue, from time to time, to accrue therein; and, that the said Museum is also possessed of a large remaining stock of its own publications, printed at the public expense, which remaining stock is, at present, useless to the public.

* We beg to add our earnest recommendation of the subject of this petition to the attention of our readers.

That it appears from the statement of the Principal Librarian of the British Museum, in the evidence (No. 565, 6, 7) taken before the Committee during the last Session of Parliament, that the "bestowing duplicate books or duplicate objects of curiosity upon district institutions or libraries, would make the duplicate objects more useful to the community, and might be done, consistently with the Act of 47 Geo. III."

Your petitioners, therefore, humbly pray your Honourable House that they may be allowed to partake, with other institutions, in the disposition of any duplicate books, prints, coins, objects of natural history, and other curiosities, which have already accumulated, or may, from time to time, accumulate in the British Museum, should your Honourable House judge it expedient so to dispose of these objects.

And your petitioners will ever pray, &c.

THE SUPPLY OF ELECTRIC CURRENTS TO PLANTS, &c.

Sir,—The very interesting papers on this subject by Mr. T. Pine, in your Journal, have particularly engaged my notice, as they happen to coincide, in some degree, with certain speculations in which I have myself indulged at different times. Circumvolving the atmosphere of air, there are good grounds for asserting the existence of a denser fluid orb, generally apparent, and called the sky; but, unfortunately, too hastily deemed in modern days merely an extension of the diaphonous medium we breathe. Imagine, then, this pellucid container of the aërial firmament and nucleus, earth, obedient to the known laws of nature, swiftly whirling its tremendous bulk around that rarer separator from the inner sphere, maintaining the elasticity of the air by the constriction thereof (so that we are in no danger of finding it left, like a comet's tail, to trail in orbicular length in the wake of its planet's path, and dim the passing moon), and we shall at once grant that a vast electrical machine is continually charging the enveloped atmosphere; or, as Messrs. Pine and Sturgeon remark, "allow that the earth actually receives such an influence from the sun, and is thus perpetually whirled round with its immense conducting apparatus for the purpose of imparting a vegetating principle to the system of plants, at the same time that light and warmth are conveyed." I would only briefly observe, in support of this theory, that the single tide (diurnal) of the air, and the antipodean tides of ocean, would be results consequent from the presence of such liquid boundary; for, say at the conjunction of the sun and moon (the difficult problem of Newton to La Place), that the surrounder recedes from the average proximity (45 miles, less or more), at the opposite part of this outer sphere, the straitened depth of air and the answering swell of the lower waters would be found to prove the cosmogony of Moses, and the inferential surmise of the "Principia's" desideratum.

I am, Sir, yours respectfully,
WM. F. GODOLPHIN WALDRON.

97, White Lion-street, Pentonville.

PRESERVATION OF COPPER SHEATHING.

Sir,—The following method of preserving copper under ships' bottoms, for a considerably longer time than usual, is, I believe, but little known:—

Tar from wood or tar from coal contains a quantity of acid, which is a particular enemy to metals; this is shown in chemistry, in the course of manufacturing white lead, red lead, verdigris, and other colours, which are made by evaporation of acid, or its combination, with mineral substances. If this acid, which exists in the wood of the ship's bottom, in the tar wherewith the bottom is payed, and in the tar in which the paper or felt is soaked, can be got rid of, it is evident that the copper sheathing would last much longer. Some years ago, the copper covering of a house in the Royal dock-yard at Carlscrona, Sweden, being stripped off in the course of making some repairs, a quantity of lime-paste was found laid under a few of the plates, which were in an excellent state of preservation, and apparently likely to have lasted double the time of the others. Professor Berzelius, of Stockholm, the eminent chemist, when asked the cause of this, explained that nothing neutralises or kills the acid from wood so effectually as lime. Now, I am of opinion, that if paper or felt were soaked in a mixture of boiled oil, and as much slacked lime as the oil conveniently could contain, it would make a ship's copper bottom last for double the usual time. If oil be considered a too expensive article,

the lime may be mixed with tar; but this would not be so effectual, for although the lime would kill the acid in tar, it would not entirely prevent the acid passing from the wood through the paper or felt. It would perhaps be worth while for some shipowner to try the experiment, and sheath one side of a ship's bottom in the common way, and the other in the manner I recommend; the result would be ascertained in seven years, or perhaps in a shorter time. The lime would not injure either the wood or the copper.

I remain, your very obedient,

J. F. OLANDER.

43, Fore-street, Limehouse, London,
April 4, 1836.

RISE AND PROGRESS OF HOROLOGY.

Mr. E. Henderson, to whom our pages have been indebted for some valuable contributions on clock-work and planetary machinery, has lately published a short "Historical Treatise on Horology," which we have great pleasure in recommending as deserving the notice of all who, from business or taste, are interested in this most scientific and curious of all the branches of mechanics. The author states, that "should it meet the approbation of the public in general and the trade in particular, it is intended that the subject of horology shall be entered upon in theory and practice, in all its branches, illustrated with numerous engravings." Of its meeting with "approbation" we make no doubt; we only wish we could be as sure, that the approbation would be such in degree, as to encourage our worthy correspondent to pursue his labours. One important thing we must take leave to tell him is wanting to ensure success—not certainly talent, nor research, nor information—but simply the clerical skill requisite to present the results of all these in a readable (not to say attractive) shape to the public. What would Mr. Henderson, or any other horological amateur, say of a chronometer the hands of which were seldom by any chance in the right—the second-hand at one time doing the office of the minute-hand—the minute-hand at another returning the favour—and the hour-hand (as it were) provoked by the excessive *eccentricity of its young friends*, coming every now and then to a dead stop, when it should keep moving? Would he not at once throw it aside—were even the excellence of the interior mechanism such as human skill never before surpassed? Even so it is with a very ill-pointed book. A book, like a watch, is but made to be read; and if, from ill pointing, it cannot be read with ordinary facility, it will be as certainly thrown aside as the other. After all, perhaps, our brethren of the type are in the present case more to blame than the author of the treatise; they *might* have volunteered some useful assistance, and we think *should* have done so. Be this as it may, the blemish is one which, if not remedied in the proposed continuation of the work, will, we apprehend, be fatal to its prospects of success. We subjoin an extract that will serve to show at once the substantial worth of the treatise and its accidental defects; and lest our printers should think of doing for Mr. Henderson what his own have deemed superfluous, we beg that they will give the extract as they find it, *verbatim et literatim*:—

"According to Dr. Derham, the oldest English made clock extant is the one placed in the principal turret of the Palace Royal, Hampton Court, near London, it was constructed in the year 1540 by a maker of the initials of N. O. The editor of the article "Clock-work" in *Dr. Rees' Ency.* very properly observes, that when we consider that this clock contains mechanism for representing the motions of some of the heavenly bodies, and that the celebrated Copernicus was living at the time of its date, and had not yet published his work "*On the Revolutions of the Celestial Orbs*," when we reflect also that more than a century elapsed after this time before the invention of the pendulum was applied as the regulator of clocks, these considerations appear sufficiently interesting for a minute examination of the wheel-work of this ancient clock, particularly of that part of it which constitutes its celestial mechanism. Dr. Derham, in his *Artificial Clock Maker*, third edit. Lond. 1714, states, that the Hampton Court clock shows the time of the day, and the motions of the Sun and Moon, through all the degrees of the zodiac, together with the matters depending thereon, as the day of the month, the Sun and Moon's place in the ecliptic, the Moon's southing, &c. &c. To show how completely (for that age) the wheel-work was arranged, will be best known from the following short detailed extract from the same little work:—In the centre of all, both the dial-plate and

its wheel-work are placed on a fixed arbor, which hath a pinion on the end of it which drives both the solar and lunar motions, by means of a large wheel of 288 teeth turning once round upon it every 24 hours, which large wheel is drawn round by a pinion of 12 leaves, fixed on the arbor of the great wheel within the clock frames, which turneth once round in an hour; the wheel 288 thus turning round in 24 hours, carries about with it a wheel of 37 teeth and its pinion of 7 leaves, this pinion of 7 leaves turning round with wheel 37, drives another wheel having 45 teeth which carries round the Moon's ring and circle; on the opposite side of this wheel-work, a pinion of 8 leaves extends, and did drive a wheel, but said wheel and its pinion being taken away, the numbers of the wheel and pinion is unknown, the pinion of this wheel, however, turned round a wheel having 29 teeth, furnished with a pinion of 12 leaves, which turned round a large wheel having 132 teeth which carries round the Sun and the zodiacal matter. These were the numbers of the wheel-work remaining in the year 1711, but the before-mentioned wheel and its pinion were taken out formerly by some ignorant workman that was not able to amend the clock; they were however supplied, and the whole movement repaired by Mr. Laug Bradley, Fenchurch Street, London, vide *Dr. Derham's Artificial Clock Maker*, 3d edit. Lond. 1714, p. 121 and 122. This description gives a very clear idea how the several movements were actuated; but the numbers of a wheel and pinion in the solar train being unknown, leaves that movement incomplete, thus, $\frac{?}{8} \times \frac{29}{?} \times \frac{132}{12}$, so that the original combination of wheels and pinions for the annual motion unfortunately cannot with certainty be ascertained. The writer of the article Clock-work in *Dr. Rees' Ency.* (before referred to,) states, that after he had drawn up the various particulars regarding this clock, he felt an inclination to inspect it; this was on the 8th day of May, 1805, when he embraced an opportunity which occurred of gaining permission to ascend the lofty situation in which the clock is placed. It proved on a minute and careful examination of its several parts, that the whole of both the annual and lunar movements are different from the original ones recorded by Dr. Derham; the lunar movements was found to be $\frac{59}{10} \times \frac{45}{9} = 29\frac{1}{2}$ days for a synodical lunation, the annual train was found to be $\frac{73}{12} \times \frac{42}{7} \times \frac{150}{15} = 365$ days exactly; the central pinion was a double one consisting of a 10 and a 12, fixed as the former one of 8 is described to have been, and pinned together; they are of the wood called box, as are also the pinions 7 and 9, to prevent *their cankering, (oxiding)* the *wheel 42 is made of brass,* but the rest being very large are made of iron; the gre at whee of 288 teeth which connects the clock work with the astronomical movements, appeared to be the only portion of the original work, both by its marks of antiquity and the number of its teeth, which are cut on its inner edge (interior circumference,) there are two cross bars rivetted to this indented rim to carry the celestial movements, and as there was no counterpoise to them, it was suspected that their rising and falling weight would alternately accelerate and retard the going of the clock, which is connected with it by means of a horizontal arbor of about three feet long by estimation, an enquiry into this matter proved the accuracy of this conjecture, for it appeared that the time of the day indicated *was sometimes about five minutes too slow, and at other times as much too fast;* the inscription "L. Bradley, 1711," is engraved on the frame of the going part of the clock, which has evidently been new, either the whole of it at that time, or some part of it since, so that what the original regulator was does not appear, the initials of the maker's name "N. O," are now not to be found; there are three barrels and weights, one for the going part which has a very long heavy pendulum, one for the striking part, and one for the quarters, the present scapement is a pair of pallets acting alternately into pins projecting from the plane of a wheel with a horizontal arbor or axis; according to Berthoud, this kind of scapement was invented by a Mr. Amant, a clock-maker at Paris, late in the eighteenth century. So it would seem that this clock had been again altered and repaired, somewhere between the years 1760 and 1800; in Grose's *Antiquities*. it is stated, that the astronomical furniture of this clock was invented by Thomas Tompion, the celebrated clock-maker; this account cannot be correct, for that ingenious artist lived in Dr. Derham's time. Tompion died in 1669, which period is about 129 years after its construction; it is probable, however, that he might have been employed upon it, and thus given circulation to this current account; the hands and circles are in the following order upon the dial-plate, 1st or interior circle is divided into 24 hours for the Moon's southings, after this manner, 12, 11, 10, &c. 2d, Moon's age circle divided into $29\frac{1}{2}$ equal parts; 3d circle is furnished with the ecliptic with its signs, and days of the month; 4th, Sun or hour hand revolving in 24 hours; 5th, the dial circle divided into 24 hours in the usual manner, thus, 12, 1, 2, &c. the Moon's phase is exhibited in a circular opening in the hour-hand, which covers more or less of a plate, part of which is blackened elliptically, placed under it; the form and action of this plate will be readily understood from a perusal of either Ferguson's

Select Mechanical Exercises, or to the *London Mechanics' Magazine*, vol. xiv. page 289, which gives a short detail of my tide-table."

THE POTATOE.

A plant, second hardly to any in point of importance in furnishing food for man, requiring also the same climates, has been introduced into the same countries. This is the potatoe, for which India as well as the rest of the old world, is indebted to the new world. It has been found in a wild state, in 33° of S. latitude, in Chili, in the mountains near Valparaiso and Mendoza, and also near Lima, Quito, and Santa Fé de Bagota; but in these situations it is supposed to have escaped from a state of cultivation, as the illustrious Humboldt argues that it must have travelled north in "the course followed by the Incas in their conquests." But it was introduced into England from Virginia, in 1586, by Sir W. Raleigh, and not known to the Mexicans in the time of Montezuma; he concludes it as probable, that if the English colonies did not receive it from South America, this plant was originally wild in some country of the northern hemisphere, as it was in Chili. This conjecture has been singularly confirmed by the potatoe being found wild on the Pie d'Orizaba by Deppe and Schiede (D. Don).

The potatoe, we are informed by Dr. Ainslie, was introduced into India from the Cape of Good Hope, and some of excellent quality are produced in the Mysore country, particularly at Bangalore and Nundydroog. They are grown all over India (*Roxb.*), and of a very fine quality in the cold weather, or from October to March, along the planes of India from Patna to Loondiana. Dr. Wallich states, that "they are planted in the valleys and lower hills of Nepal, so as to afford fresh crops all the year round: the roots are planted in February, June, and November, and gathered after three months." They are introduced into the northern mountains, and grown in the neighbourhood of Simla, at an elevation of 7,500 feet; and by Major Young, on the mountains north of Deyra, at an elevation of 6,700 feet; so that Mussooree made its first appearance on the map by the name of the Potch garden. Their quality was subsequently much improved by Captain Townsend raising some from seed, which in the third year became of enormous size, and of very good quality. They are now becoming very generally cultivated, both in the hills and plains of northern India; and it is fortunate, both for sellers and consumers, that those grown in the former come in when the others are going out of season.

Potatoes are in some places becoming adopted as food by the natives of India, though more slowly than could be wished; at this we need not be surprised, as even in France their use was not generally adopted until after their introduction into Europe more than two hundred years, and then only owing to the persevering efforts of the philanthropic Pamentier, round whose tomb in Père la Chaise, they are now yearly planted; so that M. Fée remarks, "verité frappante, toujours repetée et toujours nouvelle: il faut déployer plus d'activité et plus de ressources d'esprit pour faire du bien aux hommes que pour leur nuire."—*Royle's Botany of the Himalaya Mountains*, *No.* 8.

VENTILATION OF THE HOUSES OF PARLIAMENT.

(Extracts from the Evidence of Dr. Reid, F.R.S.E., President of the Philosophical Society of Edinburgh, &c., before a Select Committee.)

Have you at all turned your attention to the subject of ventilating and warming large public buildings, as well as to the practical application of acoustics to the construction of buildings?—I have paid considerable attention to both these subjects; I have had my attention particularly directed towards the subject of ventilating large buildings; more especially from the circumstance, that on some occasions in my class-room there are 2,000 experiments performed within the hour, and unless every thing were managed with the utmost precision, the student would be obliged to retire from the class-room in consequence of the fumes that are disengaged. The means I adopted were simply taking advantage of a current which is determined by means of a column of heated air; a large furnace is kindled, and wherever it is necessary to carry off fumes, or to ventilate an over-crowded or heated room, an aperture is made into that vent, or otherwise connected with it, leading the air or fumes from the place to be ventilated.

Where do you place the heating apparatus for that purpose?—It is placed upon the floor—a few feet above it; it plays into a large vent, and wherever an opening may be made in that vent, an internal current—a current into the vent—is immediately set in

motion, care being taken at the same time that there shall be as free room given for the entrance of fresh air at a different place, as there is for the exit of the heated air.

Would you advise that such an apparatus should be placed on the floor of the House of Commons, which is the building to which the Committee is at this time devoting its attention?—By no means; I would have it worked in an independent apartment. It is fitted up on the floor in my class-room because we take advantage of the heat; we find we can carry on a number of furnace operations, of a particular description, with a moderate heat, with the same fire which induces and regulates ventilation; that being no object whatever, for the purpose required in the House of Commons, it would be better to have the furnace in another place where it would not be inconvenient.

Whether you place the apparatus below, or in or above the room to be ventilated, it is immaterial?—It is of no great consequence; but this is to a certain extent of consequence, that if placed in such a manner that there shall be a current, we may draw the air from the House of Commons, not merely by the vent, but by the lower part which supplies the fuel of the furnace with air, thus furnishing it with additional power; I wish to take advantage not only of the current which is made to ascend from the lighter current produced by the heat, but also to draw from the House of Commons the air that feeds the fire.

If the furnace were situated in an apartment immediately over the House of Commons, the air from the House of Commons would rise to it and create that draught, would it not?—It might create a little draught, but the power as produced by the furnace is dependent upon the light and expanded air rising from the fire; at times we have the air warmer without than within, and were it not for the heat actually developed by specific combustion, our currents might sometimes be reversed.

But under any circumstances, do you propose for the purpose of ventilation to have the vent tube placed in the chamber to be ventilated?—There is not the slightest necessity for it; if a communication is made by a tube towards the vent, that is all that is essential.

From whatever place the supply of air is taken, ought it not to be a spot freely open to the action of the winds and atmosphere?—It would be preferable.

Do you contemplate that when the House is crowded the ventilating apparatus should also be used at the same time?—It should be ready for powerful action at all times; but I would not propose that the ventilating apparatus *should be brought into full* action until it was absolutely necessary; it could be worked always in such a manner as the varying circumstances of the case might require; I should of all things wish to avoid any accumulation of bad air, so that it became necessary to use the ventilating apparatus with great power; but I would not put on the ventilating apparatus until Members actually began to assemble, and from that moment the ventilating apparatus being in action, it would be better to keep up the purity of the atmosphere by a general and equal flow, than by allowing bad air to accumulate and then working it with great power. In many of the buildings which I have seen there is not nearly sufficient exit and entrance provided for the quantity of air required, so that when the windows are afterwards thrown open, cross draughts are induced in every direction.

It is your opinion, that in constructing the building generally, reference should be had to the position of the doors and windows, as well as to any ventilating apparatus that may be applied to secure good and proper ventilation?—The utmost attention, I think, should be paid to this, if it be intended to use them at times to assist the ventilation; but I would strongly recommend that they should never ventilate at all by doors (that there should be double doors), nor by the windows, except under the most peculiar circumstances. There might be arrangements made with advantage for throwing open the room by doors and windows to a certain extent; but if provision be made by other means, the ventilation will be completely under control when there is a power which can be regulated. The moment we begin to ventilate by doors and windows we may refresh those who are very near, but we have a sweeping current that runs in a particular direction, and there is no equality of ventilation; some may be refreshed or perhaps injured by the draught under such circumstances, but there will be no equality of diffusion; and others may receive no fresh air at all.

Do you suppose that the same ventilating apparatus might be made applicable to the House and the Committee-rooms of the House in the morning?—That is what I should wish to see done in every large establishment, not only the ventilation of the large room, but also tubes connected with the smaller apartment, and valves arranged so that the apparatus might work exactly in the same manner as water or gas in pipes laid through a city. If there be one great chimney or ventilator through which every thing is to pass, by opening or shutting a valve in every individual room or apartment, be it what it may, any degree of ventilation can be commanded that is required. But a general difficulty has arisen in consequence of these

provisions in most places not having been made any thing to the extent that is absolutely necessary; consequently, when in full action, the doors and windows are thrown open all at once, and it disturbs every thing like unity of operation. There is another thing connected with ventilation as conducted by heated air, namely, that it is not liable to the noise produced when the ventilation is induced by the working of a fanner or other common mechanical power put in action by machinery. Further, the same power dependent upon the application of heated air will also enable cold air to be thrown in whenever it may be necessary, which may be artificially depressed in its temperature in warm seasons; this would give great relief when there are months together of continuous hot weather. I should wish to see, not only arrangements for renewing air and warming it in the winter, but for cooling it in summer, which I think might be done with very great facility.

You do not contemplate the principle of regulating it by a self-regulating action?—I should almost doubt whether that could be done; I do not say it might not ultimately be effected; but I have seen such a great number of ventilators fail in this respect, being subject to such a number of influences, that unless we were almost to attribute to them a kind of mental reaction, they could scarcely adapt themselves with precision to the varied circumstances under which they must act; but any ordinary attendant may be taught, by a little attention to the thermometer and the number of Members present, to increase or diminish the working of the apparatus to any extent.

A thermometer might be placed in some great thoroughfare, so as to be open to inspection?—Yes, it might be placed in the body of the House, so as always to be before the Members. One might easily be constructed for this purpose, both large and sufficiently delicate to be a constant check upon the ventilating apparatus; the usual register-thermometer might also be used, so that a most complete check may be obtained over the machinery, and the attendance of the person engaged in conducting it, at times when no one might be present to examine the heat, &c.

Supposing the thermometer rose very suddenly, do you think that then the apparatus you are talking of would rapidly reduce that apartment to a proper state of ventilation?—It could be made to work to any extent. I may mention, on several occasions, gentlemen may have come in from a distance, foreigners and strangers, to see the working of my ventilating apparatus; when there was nothing *doing in the laboratory*, we have put on the fire with a few pieces of wood, and in the course of five minutes we were able with that to bring it into such a state of activity that fumes produced in showing some experiments were carried with great rapidity by these ventilators, which in the course of three minutes would have filled the room to such an extent that we should have been obliged to go out, had they not been in action.

With regard to one apparatus being efficient in ventilating the new Houses of Parliament, and all the Committee-rooms and other buildings, should you adduce that as an advantage in point of economy, or in point of general equability of ventilation?—In every point of view; better than having more than one, for a very small power is quite sufficient to work a great number of small ones.

Taking the Houses of Parliament, without going to the other rooms, suppose there are thirty Committee-rooms, would you say that one apparatus should be sufficient to ventilate all this over a large surface of ground, as well as the House of Commons and the House of Lords in the same way?—They might all be ventilated by one large furnace.

It is rather a matter of judgment, arising from the extent and number of apartments, than any thing else, as to how many of these furnaces you would have?—It may be more economical to have two large ventilating furnaces if the rooms are very much apart, than to carry all the independent flues a very great length.

Can the tubes be conducted to any considerable distance from the room to the apparatus?—To any length almost; I have seen them conducted hundreds of feet without any material difference.

You would not have the tube of so large a diameter as to occasion inconvenience in making the building originally?—A tube so very large and inconvenient would not be required; but every thing would depend on the primary arrangement made by the architect; it is not a thing to be added, but to be seen from the foundation, and all those flues could be carried under ground, and there would not be the slightest necessity for one to be conducted in any way where it would interfere either with ornaments or any thing connected with the building. You may carry the air down as easily as you can carry it up. I admit, indeed, that the movements induced during the rarefaction of air are such that it would be more easily carried up than otherwise; but yet, with furnaces, the difference is not so great as to make a decided alteration in any plans connected with the arrangement of the ventilating tube.

You would be more liable to a return current in case of any mismanagement of the tubes, in case you convey them down from

the ceiling of the room?—Yes, I admit that; but, at the same time, when the furnace is attended to with moderate care, I should not anticipate there would be any danger of those accidents occurring.

As to the admission of air for the House of Commons, how would you propose to arrange the tubes for its admission; would you distribute them over the floor, or would you admit the air at one great aperture?—I should prefer that the air were taken out at one aperture, but admitted by a great many, and broken as much in its impetus as possible by the division of the tubes, as far as that could be effected; and if no arrangement be adopted for preparing the air in its temperature before it be admitted into the House, which I consider the most effectual mode of conducting a proper system of ventilation, I should perhaps be inclined to prefer that the air should be admitted at a little height, than exactly on the floor or on the ground, for though the air be admitted from the floor in 10,000 little apertures, still there is some danger of the Members feeling the effect of the direct introduction of the cold air in very cold weather. This system must necessarily be considered defective, as the cold air, though broken in its force before it could reach the Members, would tend to carry along with it a portion of the respired air with which it must necessarily mix; whereas by introducing over the body of the floor the whole of the fresh air at a regulated temperature, air once respired would be carried away, and the atmosphere would never be of that oppressive character which often increases to such an extent in some buildings, where the respired air is not so easily carried away, as to produce a very powerful sedative effect, often accompanied by severe headache, more especially when it is necessary to maintain a continued and anxious attention to any subject under discussion.

The evils of a current of a certain velocity may be equally great whether the air be moist or dry?—There must be a difference there; a very dry current of air passing across the face may produce a very different effect from a very moist one; I would consider it of equal importance, indeed of much more importance to divide the current of hot air than of cold air, because when a current of cold air is introduced, it naturally falls down and diffuses itself; but if hot air be introduced from any particular source, and in great quantity at one place, that will rise in a stream to the top, without benefiting those in the body of the building. We have had remarkable instances of that in public buildings, which it was said could not be heated, though great sums were expended upon them. At a distance of twenty or thirty feet from the floor there might often be observed a stratum of air at a temperature above that of boiling water, while below the air has been disagreeably cold.

In the admission of warm air to supply the room, it would be necessary to distribute the apparatus evenly over the whole surface of the floor?—As widely as possible.

And as numerously as possible?—Yes, so far as it could be conveniently done, the heating surface on the floor could not be too extensive.

It is necessary to conduct the heated air over the whole surface of the floor, and not to trust to an apparatus radiating the heat?—I should think it absolutely necessary to conduct the heated air when it is supplied in currents; but if you have different stoves heated by steam in different parts of the building, or surfaces of iron heated by hot water or otherwise, that may make a great difference. The great objection to stoves or large plates heated by water or steam, is the unequal currents which necessarily accompany them, and the return of respired air in a descending stream. In all lofty buildings, it is impossible to have that sweet and fresh atmosphere which might be so easily commanded in a less elevated apartment, where a stream of air might be made to rise slowly but continually from the floor to the top of an inclined roof, to be removed there by the ventilator. A lofty room is generally preferred, because, from the mass of air present, a long time is necessarily required to contaminate it; but when prolonged debates are carried on, it is evident that the very cause which prevents it from being contaminated to such an extent at first, will render it exceedingly difficult to renew the air when once it shall have been vitiated.

Would you propose to regulate the velocity of the air admitted by artificial means, or trust to its change of place simply by its altered gravity?—I would propose to have every part of the ventilating apparatus under precise control, without that, it is utterly impossible to adapt the currents to the varying circumstances of the place; arrangements ought to be made to cut off the supply entirely, to exchange a pipe of cold air for the hot air, and, in short, to effect any change upon the currents we may wish at a moment's notice.

Those apertures might be so regulated, that a person sitting in another room, by turning a handle, might open or close the valves?—Yes; it is easy to do that; at the same time it would be necessary to have them all under some general control or superintendence in case of their not acting harmoniously together.

NOTES AND NOTICES.

It is said that the Marquis of Westminster contemplates the construction of a magnificent suspension bridge over the Thames to the Red House, Battersea.

Prize Chronometers.—Government having determined on discontinuing the prizes for chronometers, which shall have performed within certain limits during a twelvemonth's trial, at the Royal Observatory, Greenwich, the last public trial terminated on the 1st inst., when Mr. John Carter, of 207, Tooley-street, was again declared (as last year) alone entitled to any reward; his chronometer, No. 160, being the only instrument remaining on trial since January 1836, although, at the commencement, in March, 1835, sixty-four chronometers were placed in competition, but, exceeding the prescribed limits, were returned to their respective makers. It certainly reflects great credit upon Mr. Carter, when we announce this as the fourth year his chronometers have, by their uniform and steady rate, under great variation of temperature, been found deserving that high and proud distinction which the Lords Commissioners of the Admiralty have been pleased to confer. The extreme error, for twelve months, of Mr. Carter's chronometer, No. 160, *was one second, 47 hundredths.—Daily paper.*

New Discovery in the Process of Casting Iron — Dr. Charles Schaffhautl, a German at Sheffield, has lately discovered that by producing an evaporation of the chlorine in making cast-iron of the second and third quality, an iron of the first quality is produced. A patent has been taken out for the discovery, of which Messrs. Hollis, Solly, and Son, of the Tividale Iron-works, are proprietors.

Ballooning.—Dr. Agme in a recent essay, which he read at the French Institute, endeavours to prove that it is possible to obtain such a hold on the upper atmosphere as to be able to direct a balloon with all the steadiness and certainty of a boat moving in the waters. This he proposes to accomplish by means of oars or levers to be attached to the car, and which are to be made of oiled skin, or cloth, capable of containing an adequate quantity of hydrogen-gas, the specific gravity of which being lighter than the air would obtain a hold on the natural fluid, as they would meet with the same resistance as the balloon does itself.—*Globe.*

Cultivation of the Vine in England.—I planted a small vineyard for an amateur, which the third year produced so abundantly as to enable him to send large quantities of fruit to his friends, and also to make a hogshead of wine for summer drink—the sorts, Burgundy and sweet water. The best method in establishing a vineyard on a small scale is this:—To plant out vines raised from buds, or cuttings, or layers (say of one year's growth), let them be put out in rows, eight feet apart by six feet from plant to plant in the rows; if the shoot is strong and well ripened, head them down at once to within two feet of the ground; when they break, let the two top buds each form a shoot, which is to be trained parallel to the ground at that height, and fasten each to an upright stake. At Midsummer shorten back each shoot to about two feet, or, if strong and plenty of fruit, three feet. The following year four, five, or six buds may be left, according to the strength of the plant, each to form a fruiting bough, and trained as before. These radiating equally from the centre, will be the maximum number allowed. Every winter pruning season each shoot is to be cut back to one well-formed bud of the preceding summer's growth, which bud is to produce the succeeding summer's fruit. In the summer pruning each fruiting bough is to be shortened back to the length before stated, allowing three or more bunches of grapes to ripen upon each. These bunches, when the fruit is stoned, should be well thinned out (say half left) to allow the berries to grow to a large size and colour equally, which adds to their weight, beauty, and flavour. If the soil is a cold stiff clay, it can be prepared by trenching it two spades deep, and burning it with faggots. If a thin soil, or a chalk subsoil, then it ought to be prepared with good loam, or rich alluvial soil, at least a foot deep. If a wet bottom, it should be drained. Plants treated in this manner will last many years; to vary the vineyard, a few plants might be trained upright to a pole, or in graceful festoons (one shoot only), which should never be headed back lower than the height you wish it to grow, the lateral shoots should be shortened back to the main stem every year, leaving only one bud as before directed; and last, in thinning over the leaves, it should be remembered that their functions are important, and necessary to the perfect elaboration of the sap, and consequently the perfection of the fruit. The hardiest sorts for our climate are the black Hambro', Burgundy, cluster, white, sweet water, and royal murcadine; but the curious amateur may perfect tenderer varieties by the aid of temporary glass, placed close over the branches in a proper position to catch the sun's rays.—*Sunday Times.*

Double-acting Gasometers—Another Claimant.—Sir, I beg to inform you the Messrs. I. and T. Waites, of Diss, have invented and constructed (without previous knowledge that there was such a thing in the world,) a double-lifting gasometer—it has been made about one year, and is in constant use and answers remarkably well. A model of it may be seen in their shop.—I remain, your obedient servant, J. M. BECKLEY. Wortham, near Diss. March 14, 1836.

Baron de Férussac.—We are sorry to announce the death of the indefatigable Baron de Férussac, the founder and editor of the *Bulletin Universel.* He had long suffered from an affection of the lungs, but did not quit his labours till just before his death. Among other excellent works, his Natural History of Mollusca was one of the first, and is illustrated by the best plates published in France; his monograph on Cephalopoda is equally beautiful, but neither of these undertakings is finished. He was always anxious to forward the views of those connected with science, and was particularly obliging to foreigners. He was in his fifty-second year.—*Athenæum.*

Errata.—In Iver Maciver's article in our last Number, p. 14, col. 1, line 4, for "rising 1 in a foot" read "rising 1 in *a* feet;" lines 5 and 6, for "the resistance has been found to be $\frac{1}{8}$th part" read "the resistance on a level has been found to be $\frac{1}{b}$." In col. 2, line 8 from bottom, for "$19\frac{1}{11}$" read "$10\frac{1}{11}$." Also in *Mech. Mag.*, No, 655, p. 434, col. 1, line 20 from top, for "$240 = b$" read "$200 = b$."

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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Mechanics' Magazine,

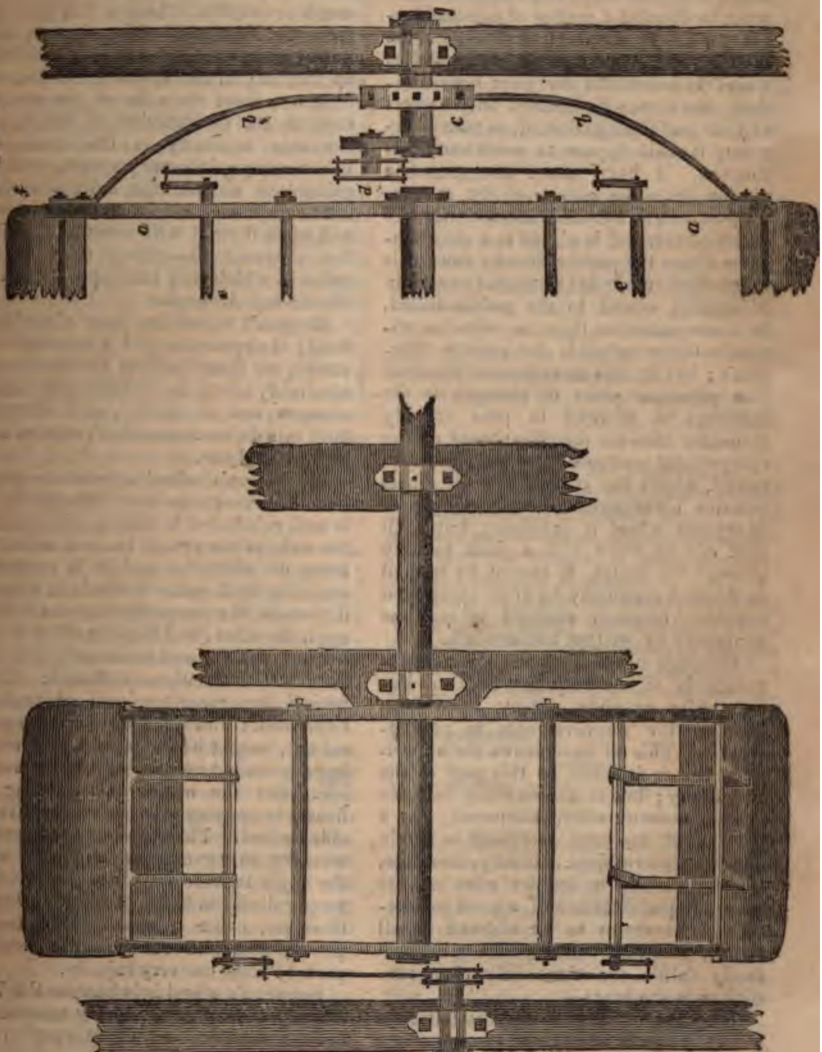
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 663. SATURDAY, APRIL 23, 1836. Price 3d.

MACKINTOSH'S IMPROVED PADDLE-WHEEL.

Fig. 1.

Fig. 2.



MACKINTOSH'S IMPROVED PADDLE-WHEEL.

Sir,—At a time like the present, when steam navigation is rapidly extending itself throughout the whole British dominions, whatever tends to its improvement must be deemed a matter of national importance. Under this impression, the inclosed sketch of an improved paddle-wheel is submitted for your consideration, that it may be inserted in the pages of your useful Magazine, if, in your judgment, it shall appear to merit such distinction. I have taken the excentric motion from the *outside* of the paddle-wheel down to a cross-shaft, which moves on its centre, and is placed at a short distance above the paddle-board; from this cross-shaft two rods (instead of one, as in Morgan's) extend to the paddle-board. It is not pretended that this wheel is original—the principle is the same as Morgan's; but by this arrangement the shaft (the principal point of strength in the framing) is allowed to pass entirely through: thus all the advantages of the epicycloidal motion of the paddles is retained, whilst the strength of the wheel remains unimpaired. The principle of Morgan's wheel is excellent; but until that can be fitted with a shaft entirely through the centre, it cannot be trusted or deemed seaworthy by any experienced engineer, however strongly it may be supported by written testimonials.

Although steam-navigation is of comparatively recent introduction, no less than fifty or sixty patents have been granted for improvements in paddle-wheels. This at least shows the importance that is attached to this part of the machinery; but in almost every instance it has, unfortunately, happened, that a great deal has been sacrificed to attain one particular object. It may, therefore, be worth while to inquire what are the essential qualifications of a good paddle-wheel. It seems to be allowed on all hands, that that wheel which most perfectly fulfils the three following conditions is the best:—

1st. That gives the most effective stroke, or greatest amount of propelling power.

2d. That most effectually clears itself of the back-water, and thereby causes the smallest amount of swell astern of the vessel.

3. That is simple in its construction, durable, and not liable to derangement.

There has no paddle-wheel yet been offered to the public which completely satisfies these conditions, although it must be allowed that some have approached much nearer than others to this ideal perfection. Nearly all these fifty or sixty patent wheels are laid aside, or cushioned, as they say in the House of Commons; however, there are a few of the more recent in the construction of which considerable ingenuity is displayed, and which appear, in some respects, well calculated to obviate the evils that have been complained of in the common wheel, and upon these I will venture to offer a few observations—taking them in the order in which they have appeared in the *Mechanics' Magazine*.

Morgan's wheel has been already noticed; it appears to give a most effective stroke, to clear itself of the back-water admirably—but is wofully deficient in strength and durability, and therefore until this defect is remedied, cannot come into general use.

Symington's wheel appears to give a less effective stroke than Morgan's, but is well calculated to *destroy the swell* in the wake of the vessel, because as the two floats of which the paddle is composed cause the back-water to recede in opposite directions, the one portion acts as a check upon the other; and thus the effect is neutralised, and the evil consequences arising from the undulations obviated. These wheels are, therefore, well adapted for river work; and were they in more general use, might be the means of preventing a great and unnecessary loss of human life. But the manner of working the floats, or causing them to revolve, is decidedly bad. The friction upon a roller working in a groove is very great when the angle is sufficiently acute to give the proper direction to the paddles, and must, therefore, cause a considerable loss of power, and also occasion the working parts to wear out very rapidly.

Seaward's wheel is (whatever the Vice-Chancellor may say) nothing more or less than a modification of Morgan's; the construction is the same in every particular, except as it is expressed in the affidavit of Messrs. Morgan and Lucena, the excentric is caused to "revolve on an *enlarged axis* affixed to the side of the

said steam-boat." It is not here intended to insinuate that Seaward's wheel is an infringement upon Morgan's or Galloway's patent; on the contrary, it is notorious to every one at all acquainted with the subject, that the principle of causing the floats of a paddle-wheel to revolve by means of an excentric was well known and acted upon many years before either Messrs. Galloway, Morgan, or Seaward, attempted, or possibly even thought of attempting, to accomplish that object by the same means. All that is meant to be here asserted is, that Morgan's wheel and Seaward's are the same in their mechanical construction, except that in Seaward's the main shaft passes through the wheel, and the excentric works upon an "enlarged axis." In point of strength and durability, when compared with Morgan's, Seaward's wheel has decidedly the advantage. But as regards the excentric action, the friction of the working parts, especially upon the "enlarged axis," is so very excessive, and presents so great a drawback on the working of the wheel, that it is very questionable whether it possesses any superiority, or whether it is, in all respects, even equal to the common paddle-wheel.

Carter's wheel is, in principle, a combination of Morgan's and Symington's; there is much ingenuity displayed in its construction, but it is too complicated. It bears evident marks of being the production of an amateur engineer, and may suit very well his amusement or recreation, but appears ill-adapted for the purposes of navigation.

And last and least, Galloway's second patent. This wheel has been strongly recommended by the inventor on account of its simplicity and *power;* and how is this power obtained? The inventor says, in his circular, that of the series of bars of which his paddle is composed, "*the lowest bar only* encounters a resistance at entering, the other bars following in its wake or path." If this were really the case, a very considerable portion of the power must be lost altogether, as it is by the resistance which the water opposes to the revolving of the paddle-wheel that the vessel is propelled, and, consequently, an increase of speed cannot be obtained under such circumstances. This wheel is calculated, however, to obviate one evil —the tremulous motion or vibration communicated to the vessel by the successive striking of the paddle-boards as they enter the water; but this object might be equally attained by fixing the bars composing the paddles at regular intervals upon the outer rim of the wheel, or by placing them upon steps, as in the patent wheel—in either case, it is simply dividing the heavy and perceptible stroke of one great paddle-board into several lesser, which are not so perceptibly felt. The merit of this wheel certainly lies in its simplicity; and perhaps the inventor himself may be allowed to possess equal merit of the same description.

Sir, I have animadverted freely on the several paddle-wheels now before the public, as I conceive I had a right, and was perhaps, in some measure, in duty bound to do; and shall conclude with this observation, that I freely concede the same right to any gentleman who may feel disposed to criticise this which is now submitted to the public.

I remain, Sir, yours respectfully,

THOS. S. MACKINTOSH.

101, Long-alley, Finsbury, Feb. 25, 1836.

Description of the Engravings.

Fig. 1, represents my paddle-wheel with stay-braces or outside bearing; and fig. 2, a paddle-wheel without the outside bearing; the former of these arrangements I consider the best.

In fig. 1, *a a* is the wheel; *b b*, stay-braces, fixed firmly into the brass collar *c*, which collar works freely on the pin *g*; *d*, excentric motion; *e e*, cross-shafts; *f f*, paddle-boards; and *g*, pin to support the outside of the wheel by means of the stay-braces *b b*.

MERRYWEATHER'S FIRE-ENGINE BRANCH-PIPE.

Sir,—Many circumstances have prevented me from resuming the consideration of certain hydraulic phenomena that were under discussion in your last volume, until a comparatively recent period, when I had an opportunity of repeating the experiment which gave rise to the question, and also of making some other experiments, alluded to in my communication at page 227; the results of which, but for a severe domestic affliction, should ere this have been laid before your readers.

On making another trial of the flat-topped branch-pipe, described at page 6 of your 23rd volume, I found I had committed the error attributed to me by J. L.,

of having overlooked the contraction of the jet during the slow working of the engine, and I thank that gentleman for his correction. The contraction must inevitably have taken place, although it entirely escaped the notice of all the persons present at the first experiment. I subsequently found that the head of water in the engine-cistern (somewhere about three feet) was of itself sufficient to give a slight jet, in which the contraction was as clearly defined as in the higher ones. It is therefore evident, that with the *simple orifice*, the smallest pressure that will give a perceptible jet will also cause its contraction.

M. Bossut found that when the height of the reservoir was augmented, the contraction of the fluid vein was also increased, and the expense of water diminished; but we were unable to perceive any difference in the amount of contraction, whether the jet was one foot or fifty feet high. Our observations correspond with those of M. Bidone in this respect, although at variance with the opinions of some other experimentalists; one thing is certain, that when the pressure is produced by the working of an hydraulic machine, such as a fire-engine for instance, it is quite impossible that the expense of water should be diminished *under increased pressure.*

I have searched several works of repute in vain for a correct delineation of the *vena contracta;* M. Bossut has dedescribed it as a kind of truncated conoid, whose greatest base was the orifice, having its altitude equal to the *radius* of the orifice, and its bases in the ratio of three to two. M. Bidone and Sir Isaac Newton considered the greatest contraction of the fluid vein to take place at a distance *not more* than *the greatest diameter* of the orifice; it appears to be within the distance of the *radius*, and of the form represented at page 6 of your last volume.

M. Bossut has stated the result of some experiments which he made on jets of various forms, to be, that jets rise to the *smallest height* when the adjutage is a cylindrical tube; that a conical tube throws the fluid *much higher;* and that when the adjutage is a *simple orifice*, the jet rises *highest of all!*

It is possible that this statement led to the employment of the flat-topped branch-pipe *before alluded to*, but the result by *no means corroborated* M. Bossut's statement; on the contrary, the jet of water was sadly disfigured, and fell greatly short of the elevation attained with other orifices.

Ineligible as the *simple orifice* has been proved to be for the adjutage of a fire-engine, it is not quite the worst that can be employed. Venturi obtained the maximum quantity of water that could be delivered through a given orifice, by making the discharging-pipe in the natural curve of the fluid, and by continuing or rather reversing the curves so as to enlarge the end of the orifice. Accordingly, I procured a branch-pipe of this form, represented in section by fig. 1.

Fig. 1.

In practice, however, this branch was found much more objectionable than the simple orifice, the stream of water being divided into a fine spray, and thrown about in every direction with a rapid rotatory motion.

The best form of adjutage for hydraulic-engines has long been matter of considerable speculation; the general practice hitherto has been, to make the discharging-pipe conical, with a cylindrical space at the end, equal in length to the diameter of the orifice.

The London Fire-Establishment being extremely desirous of rendering their excellent engines as efficient as possible, some experiments were recently instituted by Mr. Braidwood, the Superintendent, for the purpose of ascertaining the comparative advantages of nose-pipes of different forms. The *flat-topped* and *trumpet-shaped* branch-pipes have already

been noticed as altogether unsuited for this purpose.

It having frequently been asserted, that the best form for a discharging-pipe was that of the *vena contracta;* Mr. Merryweather constructed a branch-pipe terminating in an adjutage or nose-pipe precisely of that form.

Mr. Tilley submitted a very pretty branch-pipe, furnished with a nosel about six inches long, in which a more easy curve was employed, conformably to the hypothesis of Newton.

Both of these appeared to have an advantage over the common conical branch; but a second nose-pipe made by Mr. Merryweather, which was a sort of medium between his first and that of Mr. Tilley, appeared to have a most decided advantage. With this branch-pipe a very beautiful jet was obtained, the stream of water being delivered in a compact body at a much greater elevation than with any others that were tried.

Fig. 2.

Fig. 3.

Fig. 2 is a section, and fig. 3 an external representation, of Mr. Merryweather's improved branch and nose-pipe, on a scale of two inches to a foot. It consists of a slightly tapering copper tube *a*; the female-screw *b* is for attaching it to the hose, a male-screw at the other end receiving the nose-pipe *c*, the form of which will be at once understood from the sketch. The length of the whole is but 21 inches, and the weight only 4lbs. It will be observed, that in this branch-pipe the stream of water is continued nearly of the full size of the hose, till within less than three inches of the discharging orifice, when the velocity of the water becomes accelerated, and the jet formed under the most favourable circumstances.

The importance and great advantage, in all cases of fire, of throwing a jet of water point-blank upon the burning materials, was strongly insisted upon and strikingly exemplified full forty years ago by Mr. Van Marum, some of whose experiments are detailed in one of your early volumes.* But the correctness of this view, and the immense advantage resulting from its practical adoption, have recently been most extensively and successfully demonstrated, particularly in Edinburgh and in London, by the firemen under Mr. Braidwood.

For the effectual accomplishment of this most desirable object, the improved short branch-pipe of Mr. Merryweather is peculiarly favourable, as either in standing, kneeling, or lying down, the fireman has the power of throwing a jet of water all around him with a facility before unknown, and into places where no other branch-pipe could be directed.

For external operations, where great heights have to be reached, the nose-pipe *c* can be screwed upon a longer branch without any prejudice to the effect, but for *close combat* the short branch is unrivalled.

Notwithstanding the comparatively recent date of the experiments, which fully established the superiority of this branch, it has already come into very extensive use. Besides being adopted by the London Fire-Establishment, it has also been employed by the non-conforming fire-offices; the fire-engines of many of the nobility and gentry, as well as those belonging to the Admiralty, the Temple, the Mint, and many other public offices,

* Vol. iii. p. 184.

have been supplied with new branch-pipes of this pattern, with uniform advantage, and it seems likely to obtain, as in fact it really merits, universal adoption.

I am, Sir,
Very respectfully yours,
WM. BADDELEY.

London, April 14, 1836.

THE BRITISH MUSEUM.

Sir,—I am glad to perceive from the letter of S. S., inserted in your last Number, that he proposes to furnish you with a list of the "permanent and public" literary institutions of the kingdom. I hope the catalogue will turn out more lengthy than I anticipated; but to say the truth, in spite of the gallant bearing of S. S., and the chivalrous promptitude with which he has accepted my challenge, I have still my doubts whether in the course of his inquiries he will not find the troop, which he has undertaken to marshal to the public, such a thorough "ragged regiment," that he will decline to "march through Coventry with them" after all.

But whatever may become of the "public and permanent" institutions of other parts of England, I cannot but anticipate a general crash of the numerous private and self-supported establishments of a literary nature about London and its neighbourhood, in case the alteration in the management of the British Museum, recommended by your correspondent, F. S. A. (in page 535 of your last volume), should be carried into effect. I am well aware, indeed, that the measure which he advocates—the "erection of a detached fire-proof reading-room for evening visitors"—is a favourite one with many, even of the members of the House of Commons' Committee now sitting on the affairs of the Museum; and I certainly cannot deny that the convenience of it to frequenters of the Museum would be immense; but has it ever been considered what would be its effect on the other London libraries now existing? How many persons, for instance, would be found inclined to pay a not-inconsiderable sum for the privilege of admission to the London, the Royal, the Russell, or other similar institutions, when within five minutes' walk of some of them, might be found a gigantic rival,—compared to them an "Ossa to a wart,"—the price of admission to which would be just nothing at all? At present, the mass of visitors to these excellent and most useful institutions congregate together in the evening, the great majority having been occupied in business during the day, and merely devoting a few hours to literature for their own private information or amusement. The day-readers at the Museum, on the other hand, are in general those who are either pursuing literature as a profession, or following out some particular course of study to which they give more than ordinary attention. Some mere devourers of novels and magazines have indeed found their way into *that* reading-room; and few as these are, there are more than enough; but compared to the main body of readers, they are "in them but not of them," and must, one would think, be almost ashamed to look the servants, who bring them the volumes, in the face. That reading-room is, as the regulations observe, "a place devoted to *study*." Of course, if open in the evening it would remain so no longer. That impossibility, which is now found to exist, of excluding all but those who derive a real benefit from admission, would then (excuse the bull, if it is one,) be increased tenfold. And it is, I think, a question well worthy of more mature consideration than it hitherto appears to have obtained, whether, under these circumstances, any advantage would be derived to the public sufficient to counterbalance the great additional expenses that would necessarily be incurred, and the destruction or depreciation of the value of the literary institutions of the metropolis, which would be the almost inevitable consequence? The benefit, as I said before, would certainly be great; but thus accompanied with evils, would it be great enough?

There is an improvement in the Museum which might be effected at less expense, which I am aware of no serious objection to, and which would afford gratification to a greater number of persons—to all the visitors of the Museum, in fact, and all the inhabitants of London may visit it if they please. This would be to exhibit the medals. The collection is excessively valuable—perhaps, since the late robbery at the Royal Library of Paris—the most valuable in Europe. There is no reason, I believe, for not exhibiting these, except that, as they are kept at

present, those who inspect them can handle them, and, of course, some caution is necessary as to the persons who are allowed to inspect them under such circumstances. But might not a way be easily devised of exposing them entirely to public view, without putting them in any danger whatever? Suppose a board a foot square, perforated at each inch with a hole large enough to admit a coin, hung up or otherwise fixed within it;—this, placed perpendicularly and enclosed in a glass-case, would offer to inspection both sides of a hundred and forty-four coins: in this manner a good sized room might be made to contain a hundred thousand pieces, and would offer as handsome an appearance as a mineralogical gallery. Only the more rare and curious parts of the collection might be thus exhibited, or a change in the pieces might be made at stated intervals, if it were not thought worth while to go to this expense for the whole.

I could offer some other suggestions which have occurred to me (and, I believe, some occur to every body), for the improvement of the Museum; but, interesting as the subject always is, or as I at least have always found it, I am afraid, Mr. Editor, of exhausting your room and patience. I cannot lay down the pen, however, without adverting to the singular notice of "the British Museum" which appeared in the last part of the *Penny Cyclopædia*. You will, perhaps, be surprised to hear that this article only appeared in the *last part* of that work, after the declaration of the editors, that "no opinion was to be formed of the extent of the work in general from the space occupied by the letter A, because that letter always required more room than any other in the alphabet,"—but so it is that they have now expended about thirty double-columned pages more on the letter B than they did on A, and yet have not "progressed" three columns beyond this article in *Bri*. Singular I have called this article, and singular indeed it is—not from the extent of its information, though there is a reasonable quantity of that, and the notice bears internal evidence of being from the pen of Sir Henry Ellis, the Chief Librarian, who has used it before in the service of the Diffusion Society,—but from the gigantic enormity of its omissions. We are informed at some length of the history not only of the present Montague House, but of the one before it, which was burnt to the ground precisely sixty-seven years before the Museum was "born or thought of." We are informed with much minuteness of a whole bead-roll of "Donation MSS.," including "Ducarel's Abstracts of the Archiepiscopal Registers at Lambeth," and "a long series of calendars of the Originalia Rolls;" we are informed of the "two hundred and ninety-six stycas of Ethelred, Eänred, and Redulf, kings of Northumberland, and of Vigmund and Eanbald, archbishops of York, found at Hexham in 1832." We are informed of all this and much more of a similar character; but we are *not* favoured with any account of the number of officers of the Museum—we are *not* told what are the names and salaries of the principal of these,—we are *not* apprised of the number of visitors to the different departments (an interesting piece of information to be found in the Parliamentary Returns), we are *not* furnished with an account of the general annual expenses of the whole establishment as annually laid before Parliament,—we are *not* presented with the enumeration of the number of books in the library; in lieu of which we may content ourselves with a vague assurance that the collection is "on a range with the greatest libraries of continental Europe." This list of omissions is already so long, that our readers must have been tempted to exclaim with Lord Byron's mob-orator, that the article must contain "no nothing." What will they think when we add, that with the exception of one vague reference to the "new buildings," this account of the British Museum contains *no notice* of the gigantic erections now, and for some time past, in progress there; one single wing of which cost 120,000*l*., and dwarfs the whole old establishment for extent and magnificence? To crown the whole, from beginning to end of the twelve columns, there is *no mention whatever* of the Parliamentary Committee which has been sitting on the affairs of the Museum, has elicited so much information, and excited so much interest respecting it, and is probably destined to effect so complete a revolution in the entire system of its affairs! Compared to this, the acting of Hamlet, with the part of the prince omitted by particular desire, "comes badly off indeed." We

know not, but it may be the fashion of the officers of the Museum to join in chorus to the song of

"Oh no we never mention it, its name is never heard—
Our lips are all forbid to breathe that else familiar word."

But although this part of the *Cyclopædia* did happen to be published on the 1st of April, we think the editors might, for the credit of their publication, have avoided such a piece of Tomfoolery as this. In the other articles so solicitous are they to bring the information up to the very latest period that we find mention made of a storm at Bridlington, which took place no longer ago than the 17th of last February, so that it cannot be merely the recency of the inquiry which has prevented their taking notice of it. Perhaps they deem *the storm at the Museum* too unimportant to be put on record. We shall see. In the mean time, while the writer in the *Cyclopædia* will hardly allow his readers to believe that the Museum is not a "faultless monster," a writer in the *Athenæum* is labouring hard to convince the public, by an alternate use of the magnifying and diminishing glass—the former applied to all foreign institutions, and the latter to our own—that we and our Museum are the laughing-stock of surrounding nations. The truth lies somewhere, without much doubt, between these two extremes, but there is no need of ascertaining it to a nicety. The duty of Parliament will be discharged if it comes to a vote that the Museum "has increased, is increasing, and shall be increased tenfold."—Yours, &c.

P. P. C. R.

DR. FOX'S TURN-CAP FOR VENTILATION.

Dr. Fox planned this turn-cap in consequence of his having frequent opportunities of observing the very inefficient action of those in ordinary use, arising in a great degree from the weight of the parts which the wind has to move.

It will be found that where the principle of it is adopted, the part to be moved by the wind will not be more than fifty pounds weight, whilst on the old plan the weight of the moving parts would be two or three hundred pounds. Dr. Fox's turn-cap is not liable to be injured by very strong winds, although the moving part is so extremely light, *and this lightness causes it to be influenced by a very gentle breeze*, and hence it secures the most perfect ventilation.

Specimens of this improvement, on a pretty large scale, may be seen on the County Courts at Nottingham; and one, in a very conspicuous situation, in Sheffield: there are also many on a smaller scale in the neighbourhood of Derby.

A model of this machine was sent to the Society for the Encouragement of Arts, &c., some years ago, by the inventor, but the Committee declared themselves unable to discover the improvement. The same model which was presented to the above Committee was lent to Mr. Harrison, of Derby, from which the turn-caps now recommended to the notice of the public have been constructed; and Mr. Harrison is so thoroughly satisfied of their great superiority, that he has discarded the old principle altogether.

It is hoped this notice will turn the attention of engineers to the subject, so that the construction and principles of the machine may be thoroughly investigated.* C.

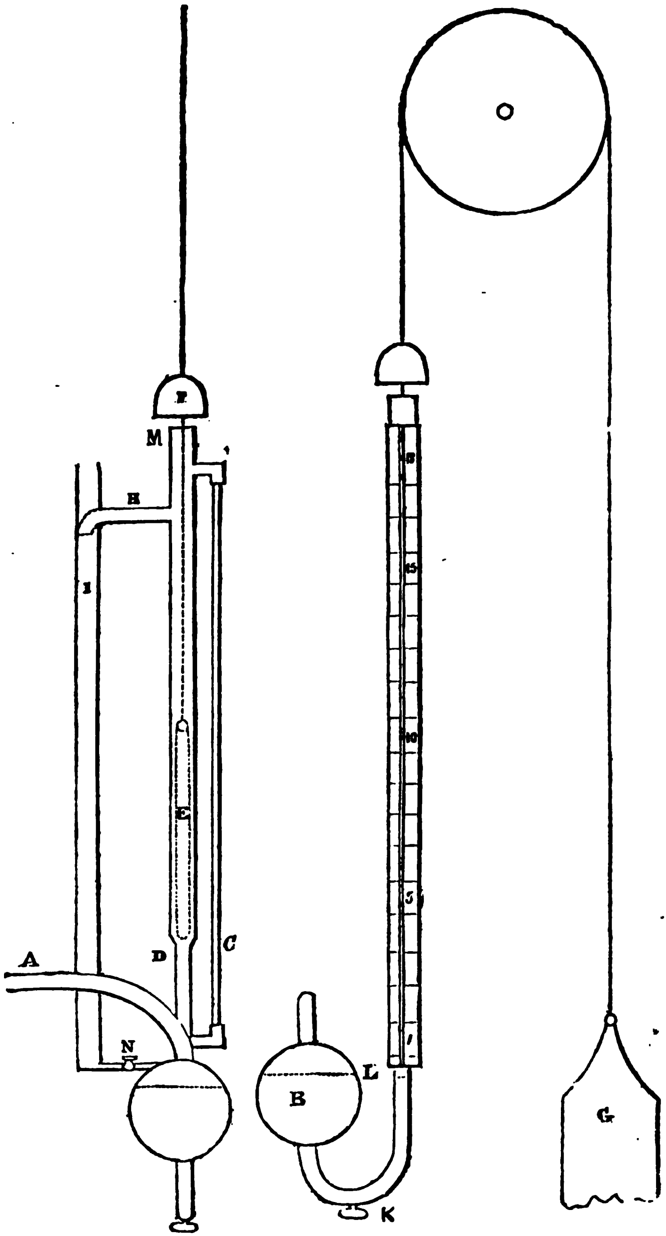
THE "RAILWAY PHENOMENON."

Sir,—I think it rather strange that the article headed "Railway Phenomenon," copied from the *Bolton Chronicle*, p. 224, vol. xxiv., should so long have passed without a comment from some one of your numerous correspondents: to me it appears highly improbable such a thing could occur; the sensation of the person at the moment of taking hold of the stone is correctly enough described; neither does the saying the stone had then attained its maximum velocity imply its want of truth, that being merely an error in judgment, as it is well known to all your readers that its maximum velocity must have been at the very instant it left the hand that impelled it; but the veracity of the writer appears, at least, questionable, on asking, very naturally, how could any one get into the situation from which the stone *must have been thrown?* Circumstances, i. e. the velocity of the train, and the absence of any sudden curve in the road, deny the possibility of such an occurrence having taken place.—Yours, &c.

TREBOR VALENTINE.

* In order that this may be done, it is necessary that the apparatus should be first described. Perhaps our correspondent will oblige us with a drawing and description.—ED. M. M.

MERCURIAL SAFETY-PIPE, SELF-ACTING DAMPER, AND PRESSURE-GAUGE FOR HIGH-PRESSURE BOILERS.



Sir,—The most important part, next to good workmanship, in high-pressure boilers is a safety-apparatus, and if a useful duty can be imposed upon it

value will be proportionably incr:ased. Many months ago I described my apparatus to several engineers, but all doubted its efficiency. Having had a small engine (3-horse power) erected on my premises to which the safety-apparatus is attached, it affords me great satisfaction to state that it is completely effective, and may be made to suit any high-pressure boiler.

Fig. 1 is a side view, and fig. 2 a front view of the apparatus.

A is a wrought-iron tube, one inch diameter, attached to the boiler, and connected with the cast-iron ball B, containing 28lbs. of mercury. When the pressure of the steam begins to act on the surface of the mercury, the level of which is at L in the ball and L in the tube of the front view, it is forced up into the glass tube in front of the scale, also into the wrought-iron tube at the back of the scale, shown at D in the side view. When it arrives a little above D, the wrought-iron tube is increased to $1\frac{1}{4}$th inch diameter inside, and admits of a cylindrical iron bar about $\frac{7}{8}$ths of an inch diameter and 14 inches long, weighing 3lbs., which, with the balance-weight F hung above the tube, are $1\frac{1}{2}$lb. heavier than the damper G. The mercury continuing to rise, floats the cylindrical bar, and gives $1\frac{1}{2}$lb. preponderance to the damper G, which, of course, descends and moderates the draught; and as the pressure of the steam abates, the bar E falls with the mercury, and the damper rising, admits a more copious supply of air to the fire. The top of the tube D is made up solid at M, except a small aperture sufficient for the catgut cord, to which the cylindrical bar is attached at one end and the damper at the other. The pulley is 10 inches in diameter. Should any over-firing occur so as to raise the mercury above 18lbs., marked on the scale, which is the height the gauge is set in the annexed figure, the mercury will follow the tube H and fall into the wider tube I, where falling to the bottom, will be retained, and the steam will rush out at the top of the tube I, which may be continued through the roof of the boiler-house. When the steam has escaped, it is only necessary to open the cock N, and the mercury will run into the cast-iron ball B; and by shutting the cock after the mercury has run in, the apparatus will be again in the same state as before, and will prove at all times an efficient safety-valve. The apparatus may be used for any pressure. The thumb-screw at K is for the purpose of drawing off the mercury to clean it when necessary. The glass tube C is open to the wrought-iron tube D, top and bottom, so that the height of the mercury is visible from top to bottom of the scale. The figures on the scale indicate pounds' pressure on the square inch.

My apparatus is open to the inspection of any gentleman or workman who may favour me with a call.

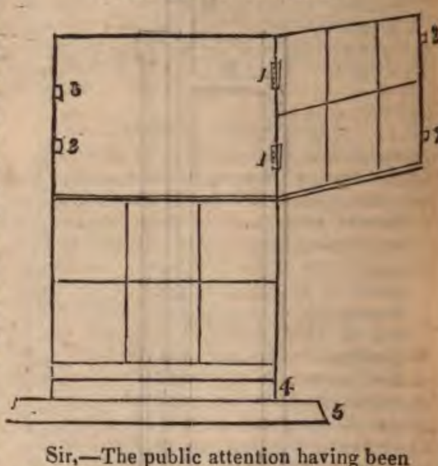
If the above is deemed worthy of insertion in your Magazine, your compliance will much oblige,

Yours, obediently,

EDWARD BUNTING.

Mansfield, March 19, 1836.

IMPROVED WINDOW-SASH.



Sir,—The public attention having been recently much attracted to the dangerous practice of employing servants, particularly females, to clean the outsides of windows, often at a great elevation from the ground, an idea has suggested itself to my mind, by the adoption of which it seems to me that the difficulty now found in reaching the upper part of the outsides of windows might be easily avoided, and at little expense. The accidents which now so frequently take place, owing to the cause alluded to, certainly render it highly desirable that some means should be taken to prevent their recurrence. I send you herewith a slight sketch of my plan, with an explanation, and should be

by its insertion in your excellent
l.

I am, Sir,
r obedient, humble servant,
D. H. (No Mechanic.)
ille, Jan. 30, 1836.

lanation of the Engraving.

ges for the upper sash to turn

ts to fasten or unfasten the sash.
les to receive the bolts.
veable partition to be fixed to
part of the frame by iron pegs.
ping-stone.
dow-sash made upon the above
be cleaned inside and outside
fect ease and safety. Let the
rt of the frame of the under sash,
w consists of one piece of wood,
of two; and let these two pieces
together by iron pegs, but so as
of their being separated as occa-
y require. When the panes of
r sash want cleaning on the out-
ach the moveable or under piece
of the lower sash, marked No. 4.
r sash will then fall so as to al-
top sash to be opened without
e from the middle part of the
This is done by unbolting the
sh, which will then open inside,
s of which may be thus cleaned
as necessary, without danger or
.

RAILWAY HINTS.

Some weeks ago you favoured
lers with an account of Professor
experiments to ascertain the ad-
or disadvantages of the chairs
being at three and six feet dis-
m each other. I wish Mr. Bar-
ention had been directed to solid
s, so as to give the rails a steady
ughout their length, as I sug-
or slate platforms. I have re-
eard that a railway from Bolton,
Bolton-le-Moors, is now being
ith a solid stone platform; per-
e of your correspondents could
ou the particulars.

I saw your notice of the pro-
for stopping the wheels on the
ch Railway, in order to produce
n the rails to retard or stop the
es, I had been thinking on the
ject. *I do not propose* using the ordinary wheels of the carriages for this purpose, but to have drags, or drag-wheels, which can be let down in an instant on to the rails. I think it probable that the ordinary wheels would soon be spoiled if used in that way. I also propose friction-wheels to let down on the rails to enable a train to ascend an inclined plane. I propose to raise and force down these drag and friction wheels by means of screws. I would also suggest elastic fenders to precede the wheels of a train, or carriage with an engine, to turn off any obstacle from the railway, or any person who may happen to be in the way, to prevent, or at least to diminish, the violence of accidents.

I would further suggest, that for railways the motion of the engine should be given to a horizontal fly-wheel, which may be placed under the carriage, and the motion communicated to the wheels by bands and pulleys. The object of this is to prevent the jar now experienced. The bands may be made tight or slack by means of a screw. If the latter, the action of the engine will be instantaneously taken off the wheels.

I am, Sir, your obedient servant,
JOSEPH JOPLING.
31, Somerset-street, April 14, 1836.

CIRCULATING DECIMALS.

Sir,—I think that your correspondent, Mr. Peacock, pp. 12 and 13, has taken a very partial view of the question to which he alludes, having only given a particular rule, and which fails when applied generally. For instance:—Given ·3823529 to find the whole of the series. By the first part of this rule we certainly obtain the whole of the series, $\cdot\dot{3}823529411764705\dot{8}$, but the second part fails completely. In this series ·058 is of the least decimal value; divide unity by this, and we obtain $\frac{1}{\cdot 058} = 17$ for the denominator; or take the next in value, ·1176, and we have $\frac{1}{\cdot 1176} = 85$, neither of which are correct, the equivalent vulgar fraction being $\frac{13}{34}$.

I consider him to have fallen into this error from the property possessed, in some cases, by the denominator of the fraction $\frac{1}{m}$, (where m is a prime number) of containing within itself always the same progression of figures, whatever the

numerator may be; for instance, if we take any numerator for the fraction $\frac{}{43}$, we shall always find the same figures constantly recur, and $\cdot\dot{0}232$, &c. being the equivalent for $\frac{1}{43}$, we shall always find $\cdot 0232$, &c. recur in every multiple of the same. But the equivalent for $\frac{1}{34}$, $\cdot 0\dot{2}94$, &c. does not recur in the multiplication by the numerator.

From this we may draw the inference, that this rule only applies to those circulates where the circle commences with the first figure, as $\cdot\dot{0}232$, &c., and fails when applied to those that commence with the second or any subsequent figure, as $\cdot 0\dot{2}94$, &c. or $\cdot 01\dot{0}86$, &c. The first are called pure, the second mixed circulates.

In the course of my investigations of this subject, I noticed the following curious methods of obtaining the same result, which are equally applicable to *all pure circulates*:—

Rule 1. Divide $\cdot 999$ *ad infinitum* by the given number.

Divide the quotient *ad infinitum* by the given number, and observe that there are the same number of figures in each quotient.

From the last remainder obtained by the first operation, subtract the next preceding one for the numerator.

Proceed the same by the second for the denominator. Thus:—$\frac{9999999}{3488372} = 2{\cdot}8\dot{6}66$ $\frac{2{\cdot}866666}{3488372} = \cdot 82\dot{1}77$.

The last remainder of the first operation, 23282479—23258479; the next preceding remainder = 24000.

The last remainder of the second operation, 27208226—27139426; the next preceding remainder = 68800, and $\frac{24000}{68800} = \frac{15}{43}$.

Rule 2. Take the first quotient for the numerator, and the second for the denominator, and by complex fractions we have $\cdot 28\dot{6}6 = \frac{2838}{9900}$, and $\cdot 821\dot{7} = \frac{7396}{9000}$, and the fraction $\frac{\frac{2838}{9900}}{\frac{7396}{9000}} = \frac{25542000}{73220400} = \frac{15}{43}$.

Rule 3. Invert the fraction equivalent to the first quotient, thus:—$2{\cdot}8\dot{6} = \frac{258}{90} = \frac{43}{15}$, inverted $= \frac{15}{43}$.

The above rules I have found, from repeated trials, to be unerring as regards pure circulates; but the rule for mixed circulates is much more complex and intricate, and depends upon the doctrine of continued fractions.

With your permission, I will send you the rule for the latter, and remain, Sir,

Your obedient servant,

G. C. L.

Kentish Town, April 15, 1836.

RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal.*)

IMPROVEMENT IN THE THEODOLITE, *Samuel Stone, Long Green, Maryland.*—The patentee states his improvement to be "in the art of measuring distances at one station with a theodolite, or any other instrument by which an angle can be made either perpendicularly or horizontally," &c. The patent, however, is taken for an improvement in the instrument, and not in the art of using it. He says, "the first improvement which I claim is the mechanical addition to the common theodolite, by extending the diameter of the horizontal limb for the purpose of forming a surface as well as a centre on which a circular rim or plate revolves, as already described; and also the application of the logarithmic calculations as applied to the circle, as already described. But I particularly claim the improvement of measuring distances by an angle at one point or station, using the pole or stave, with its graduations, for one side of the triangle."

With respect to its construction and use, the inventor says:—

"This instrument embraces all the principles of a modern theodolite; besides which, it contains the following improvements:—The first improvement is a circular revolving plate, sliding or resting upon the limb of the instrument, the upper surface of which forms a plane with the upper surface of the limb; on which are delineated a set of mathematical numbers, which supply the place of a table of logarithms, and all other logarithmic tables.

"In the second place, this instrument is so constructed as to supersede the necessity and use of a chain in all cases. The distance of any visible object can be ascertained at one station, as far as the flag-staff can be distinctly seen through the telescope of the instrument, to the exactness of chains, links, and decimals.

"It also calculates the latitude and departure of every course run, and the base and perpendicular of all elevations. It further embraces all the fundamental rules of common arithmetic, viz. multiplication, division, single rule of three, interest, mensu-

ration of superficies and solids, gauging, &c. Any question in plain trigonometry, right-angled or oblique, can be solved on the instrument correctly; including all questions that can be performed by logarithms or logarithmic tables. The whole without the use of figures or a mathematical calculation."

The instrument has received the approbation of the New York Institute, the managers of which have awarded their highest premium, a gold medal, to the inventor.

IMPROVEMENT IN THE COMMON FIRE-PLACE, *Ira A. Bean and Elijah Shinner, Sandwich, New Hampshire.*—A box is to be formed across the fire-place somewhat like a hollow iron back-log; below this box or furnace there is to be an air-chamber, and a plate is to rise vertically near its back edge, so as, with the chimney back, to form a flue for the escape of smoke. In the top plate of the box there are openings for cooking utensils; there is an opening also for admitting fuel, and tubes to let heated air into the room, which, however, will never produce this effect, as the draught will be the other way. The claim is to "the construction of the box in the hearth, and the arrangement and application of the same, with the flues, funnels, and false back, to common open fire-places; the object of which is to save room and fuel, furnish a cheap and convenient apparatus for cooking, and at the same time avoid the impure air occasioned by close stoves, and the steam from cooking-stoves."

The whole of the above-named objects will not be attained by means of this contrivance; we do not think that there will be any special convenience in its use, and it certainly will not be economical when intended for heating in the place of a well-constructed close stove.

MACHINE FOR WASHING AND CHURNING, *Charles Otis, Finksburg, Maryland.*—I make a revolving cylinder or barrel, which is to turn upon gudgeons in the usual way, and having an opening through which the articles to be acted upon may be introduced, and secured by a close fitting door, or shutter. I cause this barrel, or cylinder, to revolve in a trough which serves to catch any suds that may be allowed to escape, and which, in the churning of butter, may be filled with water, either warm or cold, according to the season of the year, and thus facilitate the operation. The parts thus far described I do not claim as constituting any part of my invention, the same having been repeatedly constructed by others; but what I do claim is the following appendage within the revolving cylinders:—I place flat wings, or buckets, on the inside of the periphery of the *cylinder, extending along* from end to end; of these there may be two, three, or more, made of flat boards, the planes of which stand in the direction of radii to the cylinder. These boards may vary in width from two to six inches, more or less, according to the size of the machine, and I sometimes perforate them with holes, to increase the agitation of the fluid. They also serve to lift the clothes and suds in washing, or the cream in churning, more effectually than the pins which have sometimes been employed for that purpose. I confine my claim exclusively to the employment of the wings, or buckets, herein described.

IMPROVEMENT IN FIRE-PLACES FOR GRATES TO BURN ANTHRACITE, *Joseph Snyder, Pennsylvania.*—The greater part of this fire-place is proposed to be made of cast-iron; the bottom of it is formed of two parallel plates, two or three inches apart, and constituting a part of a circulating flue. This may stand upon feet, raising it a little from the ordinary hearth, and on it rests the back and jambs, the back also being formed of double plates, connecting with those at the bottom. The grate is situated as is usual in open fire-places, and above it are double top-plates also forming a flue between them. Hollow columns at the corner of this fire-place, in front, connect the hollow hearth with this hollow top, the back end of which passes into the chimney, in the manner of a Franklin stove; there is a damper situated on the lower plate of the upper base, which being opened allows of a direct draught into the chimney, but when closed, causes it to circulate around the whole structure. The grate is lined in the usual way, and supposing the damper to be closed, the draught is over the sloping back into the back flue, then downwards between the two back plates, then forward in the hollow hearth, and upward through the columns into the cap flue, and back into the chimney. The claim is to "the principle of diffusing the heat of an open fire-place or grate to the hearth and parts situated below the fire, by a descending and ascending flue, or flues, and double hearth, as set forth and described."

THRASHING MACHINE, *Thomas Rucker, jun., of Murphreysborough, Tennessee, assignee of Pendleton Check, of the same county.*—In this machine there are two revolving cylinders, one placed over the other other; the upper one is furnished with knives or cutters, acting against an opposing fixed cutting edge, and these together operate in the manner of shears. The grained ends of the sheaves are fed to this cutting apparatus, and the pieces cut off fall between a thrashing cylinder and a concave, grooved from end to end, in the form of saw teeth, by which the

grain is thrashed out. The claim is to "the manner of separating the heads of wheat or other grain from the straw, previous to thrashing it by the combination of machinery herein specified and described." It is said that in this instrument "the wheat is thrashed out more completely, and with far less labour than in those machines where the whole sheaf is operated on."

PUMPS AND FIRE-ENGINES, *H. Gates, Northampton, Massachusetts.*—The body of this pump is to be a short cylinder or drum, its axis standing horizontally, and truncated or cut off on its upper side so as to reduce it to about two-thirds of its cylindrical capacity; this upper part is covered, water-tight, by a horizontal plate. An axis passes through the cylinder, and has attached to it two buckets or leaves, standing at right angles to each other, fitting the lower part of the cylinder and the two heads, water-tight, to effect which they are made of durable metallic plates, screwed together with packing between them. Each of these leaves has a valve opening outwards, or towards the upper plate of the chamber.

The upper part of the drum is divided into two chambers by a fixed partition descending from the upper plate to the upper side of the vibrating axis, against which it is to fit water-tight. There are two valves opening upwards on the top plate, one on each side of the partition, and these are both covered by a conical delivery-pipe, by which the water is to be conducted as required. The receiving-pipe descends from the bottom of the chamber into the reservoir, or chamber.

The axis is to be made to vibrate about a quadrant of a circle, and those acquainted with hydraulics will see, that if the instrument be in good order, water will be raised by it. The construction of a pump, operating as described, is claimed. We could point to very similar plans of pumps, but we do not think it necessary to touch this point. Such pumps, if made with extreme care, will work promisingly at first, but they will soon go out of order. When in the best condition, we do not believe that such a pump is equal to the common piston and cylinder, the direction of the water being quite as much changed in it.

AN AUGER, *William Jones, Portsmouth, Virginia.*—The specification of this invention is brevity itself exemplified; it consists of the following words:—"This improvement is a hollow auger made so as to embrace the bolts or fastenings in ships or vessels, and to cut the wood from around them, by which means the plank, &c., can be removed, without the delay, trouble, and expense, usually *required by splitting them out.*"

In the drawing, the auger is represented as twisted like the ordinary screw auger, but capable of allowing a bolt to pass within it. This must be a very useful thing, and, so far as we know, it is new.

MACHINE FOR CUTTING SAUSAGE MEAT, AND STUFFING SAUSAGES, *Abraham and John Keagy, Pennsylvania.*—The cutting is effected by means of a cylinder, around which are placed knives which we usually make of a triangular form, one of the sides being in contact with the cylinder. This revolves within a concave, or hollow cylinder, furnished with similar knives so placed as not to interfere with those on the cylinder. These knives are but placed somewhat obliquely, so as to stand in the direction of a spiral around the cylinders. The revolving cylinder has its axis placed horizontally in a box, the sides and ends of which are enclosed excepting where the meat is admitted and discharged. A gudgeon projects through the box at one end to receive a crank or wheel to turn the cylinder.

The opening for feeding is on the upper side, and at one end of this box; and this opening is surmounted by a vertical trunk, which may be in the form of a parallelogram, of the width of the lower box, and about half its depth, more or less. A piston, or follower, is adapted to this feeding trunk, or hopper, from the middle of which a rod rises, operating as a piston rod, being acted upon by a lever, worked like a pump-handle. The piston rod passes through the lever, and has a rack, or notches, upon it, which engage with the lever in its descent, but allow it to rise without raising the piston, so that the meat put into the feeding-trunk is forced down by each successive stroke. To facilitate the passage of the meat into the horizontal, from the vertical trunk, I form a spiral excavation in the hollow cylinder, immediately under the vertical trunk; which operates as an inclined plane in producing the desired effect. The cut meat, when it arrives at the extreme end of the cutting cylinder passes out through an opening in the bottom of the box. When the feeding-trunk is to be replenished, the lever may be turned back on its joint, and the piston removed, leaving the opening perfectly free.

When the cutting has been completed, the vertical trunk, with its piston, is used for the purpose of stuffing. To effect this, a shutter, or slider, is slipped into its place where it forms a bottom to the vertical, and cuts off its communication with the horizontal trunk, and a tin, or other tube, of proper size, is fitted into an opening prepared for it on one side of the trunk, at its lower end,

upon this tube the entrail to be stuffed is gathered in the usual way.

To allow the escape of air, this latter tube has a small tube, or opening, soldered on its outside, from end to end. This opening may be semicircular, so as to make but a slight projection on the stuffing-tube. The effect of this will be obvious.

We have not thought it requisite to give the dimensions of the respective parts, as they will vary according to convenience, and will depend upon the power to be applied, and the quantity to be cut. One thing, however, is essential, namely, that the length and size of the cylinders, and the number of knives, be proportioned to the quantity to be cut; but this can be regulated also by the pressure made upon the piston.

Apparatus for Hoisting and Delivering Burthens from Ships, *Barnabus Pike, New York.*—A frame is to be made by connecting two stout pieces of timber, sixteen or twenty feet long, by cross timber mortised into their ends. The long timbers for a railway upon which to support a carriage, which runs upon friction-rollers on their upper edges. Stout legs are framed into the lower sides of the rail timbers, the carriage has a block and tackle attached to it, by the aid of which, and a windlass, the goods are to be raised from the hold of a vessel. The carriage is then moved along the rails, which extend on to a wharf, and the packages landed. The claim is to the carriage as above described and applied, and the principle and mode of carrying and delivering the burthens.

The whole is clearly described and represented, and at certain periods we have no doubt that such an apparatus will be very useful; but the rise and fall of the tide must, in most places, very much interfere with the employment of it.

Xylographic Check Plates, *Charles C. Wright, New York.*—The plate from which notes, or checks, are to be printed is to be covered, by means of an engraving-lathe, by transferring, or otherwise, with a very light pattern, consisting of close, but fine, lines. From this the paper is to be printed, say of a light blue, pink, &c. The standing words may then be printed of another colour by any of the known methods. Should chemical means be resorted to for the removal of the fine ground, no human ingenuity, it is said, will suffice to restore and re-unite the lines; and to transfer the two kinds of printing lithographically will be equally impracticable. When used without the printing of standing words, any erasure on the fine ground will be perfectly apparent.

"The *invention consists in the prepared ground covering of paper to be used for* securities written in whole or in part, with or without standing words in the same, of different colour from such ground, substantially as above described."

Ever-Pointed Pencil Cases, *Ellwood Mears, Philadelphia.*—The improvement consists in the manner of forcing the lead out of the metal point, and is as follows:—The slide or band, which moves up and down the stick, is also capable of a circular motion around it. This slide, or band, has on its inner surface a screw thread, into which the nut of the pin, or wire, used in propelling the lead from the point, works. The band or slide is kept in its place, and pushes out this metallic point by means of two small screws fastened to the lead groove within the case, and rising on each end of the band. Thus by holding the case in one hand and turning the slide or band to the left, or, if preferred, by retaining the slide so as to be immovable, and turning the case to the right, the lead can easily and quickly be propelled from the metallic point.

"What I claim as my own invention, is the method of using the band, or slide, in forcing the lead out of the metal point, instead of the complicated works heretofore in use."

Machine for Felling Trees, *James Hamilton, New York.*—The patentee, after describing the construction of his machine, says, "this applicant in the next place describes the principle of his invention, as follows:—It consists of the combination of a horizontal saw with a crank movement, the saw being of any convenient length, but in the shape of a small segment of a circle, and the length of the crank with which it is directly connected being sufficient for the length of the intended stroke of the saw, the saw being fixed in a frame, and this moving in a centre fixed in another moveable frame which is connected with and moveable upon the same centre as that of the crank; this frame having a horizontal circular movement upon a roller, by force of a weight acting over a pulley, so as to bear the saw forcibly against the material to be sawed, the crank being made to act by any convenient mechanical motion, the whole operating so as to saw horizontally, it being designed for felling trees by sawing through the trunk of a tree horizontally, and near the ground."

Mechanical saws of this description have their uses, as for cutting off piles under water, &c., but they will never enter into competition with the axe of the American woodman; and we are well convinced that in an attempt to use them in this way, his aid would not unfrequently be required to extricate the saw from the kerf in which it would become pinched.

NOTES AND NOTICES.

House-Fly Guard.—At the Entomological Society, on Monday, a paper was read by the secretary on excluding the house-fly. The mode adopted was a net made of different coloured meshes of about three-quarters of an inch square, and which, when placed against a window, was found quite effectual in excluding the visits of these troublesome insects from the outside of the room. The same experiment was tried with meshes made of the finest black thread, one inch and a quarter square, which proved to be equally effectual. The approach of wasps was also prevented by the above mode, very few finding their way within the boundary. This was accounted for by an optical illusion in the eyes of the insect, of the highly magnifying power of vision, and the small focal length.

Expensive Tables.—Tables of tiger and panther-wood (different varieties of the citrus) appear to have been first brought into fashion by Cicero, who is said to have given for a single one a million sesterces, *i.e.* 8072*l*. One belonged to Gallus Asinius, which was valued at 8879*l*. Two, which had formerly belonged to King Juba, were actually sold, one for 9700*l*., and the other for somewhat less. Another, which had been for some generations in the family of the Cethegi, was sold for 11,300*l*., and in the time of Pliny was accidentally destroyed by fire. The largest ever known belonged to Ptolemy, king of Mauritania: it was four feet and a half in diameter, and four inches thick, being formed of two semicircular planks, so skilfully joined that the place of juncture was not discernible. These tables were generally set in a broad border of ivory.—*Mr. Aitken—Trans. Soc. of Arts.*

Heat.—At a meeting of the Philosophical Society, Mr. Whewell gave an account of the recent discoveries made by Professor Forbes, and other philosophers, with respect to the polarisation of heat. He stated, that Professor Forbes had recently obtained an additional confirmation of this discovery, by finding that heat, by two internal reflections in a rhomb of rock-salt, resembling Fresnel's rhomb, becomes circularly polarised under the same circumstances as light. It was also mentioned that Biot and Melloni have very recently ascertained that heat acquires circular polarisation by transmission along the axis of a crystal of quartz.—*Cambridge Chronicle.*

The Danube.—Austria, reflecting that the Danube, the largest river of Western Europe, flows for the greater part of its course through her dominions, and is also her own way to Byzantium, has determined to encourage upon it a line of steam-boats. This, in the form of a measure of industry, amounts to a protest against the invasion of the mouths of the river by Russia. There is to be one grand line from Vienna to Smyrna, by Constantinople; and another from Vienna to Trebizonde. The service from Presburg to Smyrna commenced on February 18th, and will employ seven boats, namely, three on the Upper Danube, between Presburg and Dreichora; two on the Lower Danube, between Slela-Cladova, Galatz, and Hirsova; one from Hirsova to Constantinople; and one from Constantinople to Symrna.

M. Brunel's Mode of Constructing Arches without Centring:—Institute of British Architects, 14th March.—The secretary read a paper explanatory of M. Brusel's mode of constructing brick arches without centring; and also explained various experiments of that gentleman, with regard to the insertion of iron hoops in constructions of brick-work in cement. * * * The principle, which was originally adopted, and its efficiency ascertained, in the formation of the shaft of the Thames Tunnel, is founded upon the cohesive power of Roman cement, coupled with a system of ties, the most eligible substance for which, from a series of experiments performed by M. Brunel, appeared to be hoop iron. The piers having been constructed in the usual manner, it is proposed to pin or secure to them a mould for the purpose of determining the contour of the arch. A narrow rib may now be carried over, and keyed, using cement (with the occasional insertion of ties), which, by its adhesion to the brick being greater than the cohesion, enables the arch to be carried to any extent within the limits of the strength of the material. The several arches being in succession, once keyed, they will be in a state to receive the whole of the materials necessary to the completion of the bridge. The bridge of the Santissima Trinità at Florence was particularly adverted to, affording a magnificent example of rubble construction, and the durability of the material. The arches are composed of a mass of irregular stones embedded in mortar, having the consistence of a single stone, or of two stones abutting against each other at the crown.—*Ed. Arch. Mag.*

The Mode of Heating the Elephant's House in the Zoological Gardens in the Regent's Park.—A mode of heating has been lately adopted with great success, in a new house prepared for the reception of the elephant in the Zoological Gardens, which appears well adapted for warming churches, chapels, and all other buildings having incombustible floors. It is thus described in the *Times*:—"It consists in a common brick drain, which is conducted under the floor around the interior of the building. At the commencement of it there is a hole in the floor to the depth of about two feet, such as would be provided for the sink to any common drain; and the other end of the drain, instead of terminating in a sewer, or cesspool, finishes in an upright chimney shaft. A small quantity of fuel is then thrown in what may be called the cesspool at the opening, and lit: the effect is surprising. The downward pressure of the air to the vacuum caused by the fire produces a draught which is equal to that of a furnace. All the smoke being driven down through the fire, is there consumed, and, with the body of heat, rushing through the horizontal drain for the length of 110 feet before it reaches the upright or chimney shaft, all, or nearly all, the heat transudes through the floor, from which it ascends with as pure a warmth as that from the sun. We understand there is a floor of concrete nearly a foot in thickness over this drain, which, with the large quantity of humidity contained in it, must materially lessen the transmission of the heat: still the warmth is considerable."—*Arch. Mag. for April.*

Sir,—I shall be greatly obliged to any of your correspondents who will, through the medium of your pages, inform me how the blowing-fan is applied for the ventilation of buildings, and if one is sufficient for two or three floors, what would be considered the most efficient situation, and the method of communication. Your early insertion will confer a favour on, Sir, yours respectfully, T. V.

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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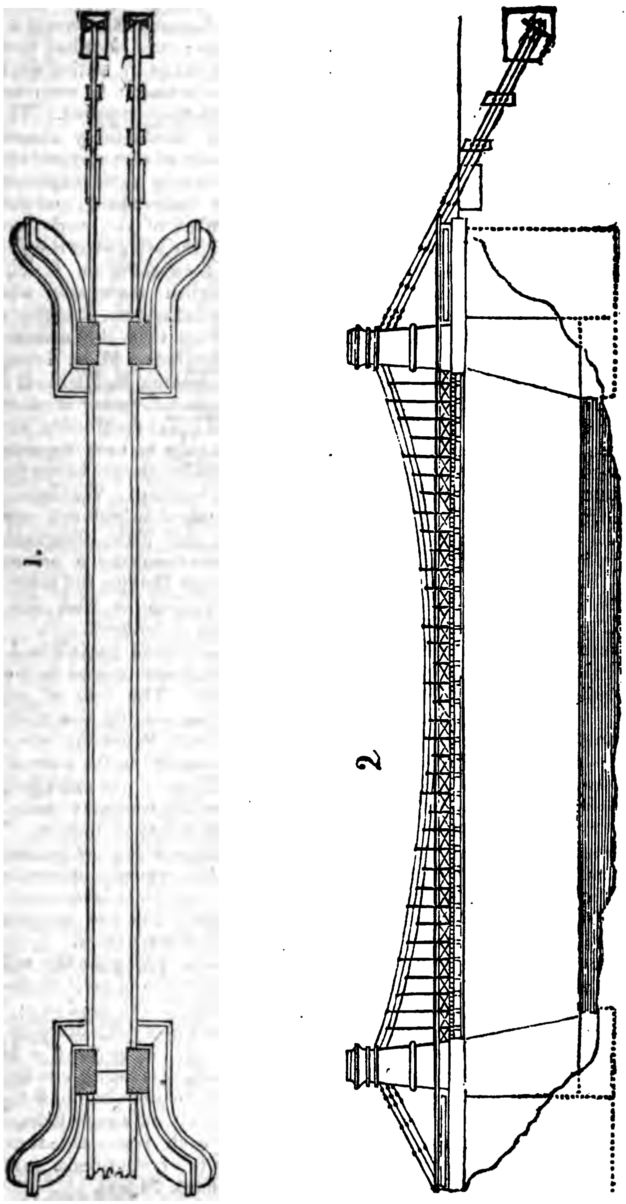


THE SAGAR IRON SUSPENSION-BRIDGE.

DESCRIPTION OF AN IRON SUSPENSION-BRIDGE CONSTRUCTED OVER THE BEOSE RIVER, NEAR SAGAR, CENTRAL INDIA, BY MAJOR PRESGRAVE.

(From the Journal of the Asiatic Society.)

We take particular pleasure in bringing to the notice of our readers the completion of this work of art, because it has been constructed entirely out of the resources of the country, being the first attempt at such an adaptation of native material and native workmanship. More than ordinary credit is due to the skilful engineer who planned and executed it, and who, moreover, from his long residence in India, could have acquired only a theoretical acquaintance with the system of suspension-bridges introduced within these few years, and now so rapidly spreading, in Europe.

The bridge was erected at the suggestion of T. H. Maddock, Esq., Agent to the Governor-General in the Ságar and Nerbada territories, upon the plans, and under the sole superintendence, of Major Duncan Presgrave, Mint and Assay Master at Sagar.

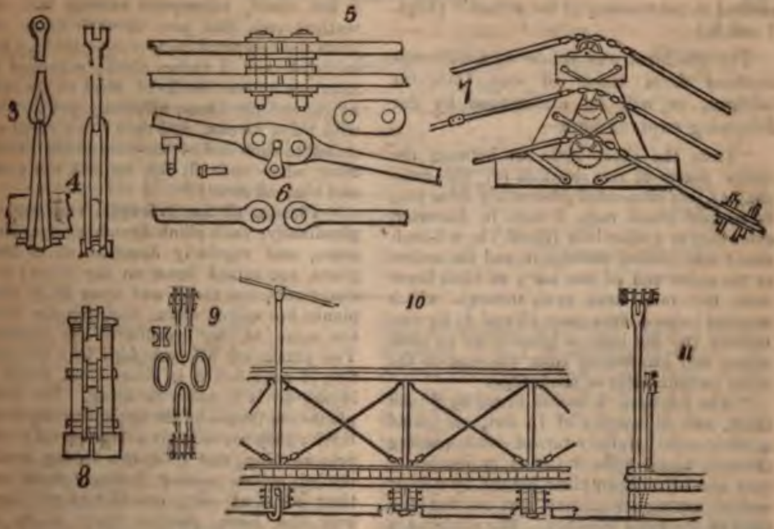
Engineers in Europe, accustomed to find every thing provided for their wants, can have little idea of the personal labour which devolves upon their brethren of the craft in this country, where to the duties of architect and draftsman are not only added those of builder and overseer, but the whole of the subordinate trades of the brick-maker, carpenter, mason, and iron-manufacturer; in a climate, too, where little exertion produces exhaustion, and incautious exposure fever or death, and where the tools must be made, and the hands that employ them instructed *ab initio*. We will not say that the native *mistrees* and labourers are not capable of learning or of working well, especially in Upper Hindustan; the bridge before us is a sufficient refutation of that common and *indolent* remark: but all will agree that a peculiar talent is necessary to manage, instruct, and drill them; and this faculty is possessed by Major Presgrave in an extraordinary degree. The secret of his influence may be easily traced—he is a workman himself; he wields the hammer; makes and works the lathe; surveys the ground; searches the mines; smelts the ore; and has all the skill of contriving with the simplest means, for which the people of this country are themselves so conspicuous.

The Ságar Bridge may indeed be called an experiment to try the resources of the country; to see whether the iron could be manufactured into bars of a quality fit for bridges; and whether these bridges could be made by native workmen who had never wrought or even seen iron of the dimensions required. The question has been satisfactorily answered; and even in point of economy, notwithstanding the numberless extra expenses incident to a first undertaking, and the distance, eleven miles, of the work from the yard at Ságar; the bridge has been pronounced cheaper than those on Calcutta, made with English materials: while of its design and execution no higher encomium can be given than the assurance of the visiting engineer, Major Irving, that he had seen nothing superior to it in Europe. The Governor-General is stated to have expressed equal satisfaction after inspection, and only to have regretted that so noble a bridge should be wasted upon so remote a locality! We have with permission taken a reduced copy of the elevation and plan, lithographed by M. Tassin, to accompany a private memoir of the Beose Bridge, the latter authentic source supplies us with the following particulars of the work.

The foundation was laid in April, 1828, and the roadway opened to the public in June, 1830. The iron of which it is composed is entirely the produce of the Ságar district. When the bridge was projected, it was still in the state of ore in the mines, whence it was extracted, smelted, and made into irregular small lumps, in the common native fashion. The working of the crude impure masses into good bars of the requisite dimensions, was a matter of very great labour and difficulty. The bridge is 200 feet in span between the points of suspension.

The piers, resting on the solid rock, 6 feet under the land level of the river, are 42 feet high to the roadway; being elevated 2 feet above the ordinary surface of the country. They have a base of 32 feet by 22½, decreasing upwards in front 1 in 5, for the sides one in 8 feet; which gives on the road a superficies of 21 by 14 feet for each pier. On the sides are wing walls or abutments running back into the bank 26 feet.

The pillars, or rather arches, of suspen-



sion, have a base of 21 by 12 feet, admitting a roadway of 9 feet broad. The arches are 15 feet high, and are faced with accurately wrought stone. The points of suspension are elevated 22 feet $4\frac{1}{2}$ inches from the road. The pillars have a total height of 33 feet, and the whole masonry from the rock 68 feet. The piers and abutments contain 82,488 cubic feet of masonry; the arched standards and bridge parapets 8,900; in all 91,388.

The platform measures 200 feet in length by 12 feet broad, and is calculated to weigh, with the chains, $52\frac{3}{4}$ tons. Supposing the bridge crowded with men, at 69lbs. per superficial foot all over the platform, the whole weight would be 120 tons: whence it is calculated that the tension to be sustained at each point of suspension would be 85,632 tons.

The suspending chains are twelve in number, arranged in pairs, three pair on either side, two feet above one another. They pass over rollers one foot in diameter, and are securely moored in masonry 16 feet below the surface of the road. The back chains are 101 fee long, rising at an angle of 27 degrees. The angle of the catenarian is 16 degrees with the horizon; the versed sine at the centre of the curve is 14 feet 3 inches.

The twelve main chains are of round bar-iron, one and a half inch diameter, bolted together in pairs; they are from 15 to 15·5 feet long, and so arranged, that the vertical rods may fall from the joints of each chain alternately in parallel lines 5 feet apart. The descending chains are square, measuring $1\frac{1}{3}$ inch on the side; their lower ends pass through 24 conically-wrought stones, below which they are capped and keyed (figs. 1 and 2).

The connecting links of the chains, and indeed all the bolt-holes in the bars and the drops, are bored out of the solid iron, and broached to fit the bolts accurately (figs. 5 and 6). None were punched at the forge. The bolts are $1\frac{1}{2}$ inch in diameter, and are secured by rings, or washers and keys. Two adjusting links, with iron wedges, are fitted to each chain, close to the masonry, to regulate its curve and dip (figs. 7 and 9).

The method of constructing the rollers is thus described in the memoir:—

"The iron rollers, twelve in number, weigh about 1 cwt. each. They are not solid, but are composed each of about 28 separate pieces of wrought-iron, viz. a centre tube or box for the axle, over which thick rings are driven; and an exterior drum, between which and the inner-ringed tube, flattened bars as spokes are driven. The centres are broached out clean and true; and cylindrical axles, 3·1 inch in diameter, were turned to fit: the ends of these axles rest on broad, thick iron bearings, mounted in very strong, solid frames of timber, well bolted, clamped, and blocked together; covered with pitch cement, and

secured in the masonry of the pillars." (Figs. 7 and 8.)

The platform was made in a different method from those of our Calcutta bridges, as will be understood by the following explanation:—

"From the short links set between the centre plates of the shackles (of the main chains), are suspended alternately from ties, 74 vertical round rods, 1 inch in diameter, connected to a short link (fig. 6,) by a 1-inch round bolt passing through it, and the socket at the upper end of the bar; at their lower ends the rods have eyes, through which doubled loops of iron pass (3 and 4) for sustaining the flat bars or girders, set on their edges, and proceeding from one end to the other on both sides of the bridge.

"The flat bars, 4 inches broad by ¾ inch thick, and in lengths of 15 feet, are joined at their ends by nicely-turned bolts, passing through bored holes 2 inches in diameter; they are adjusted in their height by double wedges resting on holders that connect the sides of the loops together. The girders are also adjustable in their lengths; the bars that enter the masonry have their ends made broader than the rest of the bars, in which are long openings 2 inches broad to receive wedges (figs. 10 and 11).

"Eight timbers in an upright position are set in the masonry of the pillars, having upright grooves or spaces cut through them, and faced with thick plates of iron; through two of these beams each end bar passes, and may be wedged on either side of the timber towards the land, as occasion may require: thus is the whole length of girder drawn more or less to either end of the bridge, and also rendered exceedingly tight and steady. The grooves in the timbers towards the river, being about 4 inches longer than the breadth of the bars, permit them to adapt themselves to their proper directions when drawn lengthwise, by the wedges acting against the landward beams; by this means the bars have sufficient play to adapt themselves to the motion of the platform, and all jirks at the pillar obviated.

"Thirty-seven double-joists, 12 feet long, are (having their ends notched below for the purpose) laid on the girders; their centres, 5 feet apart, correspond exactly with the vertical rods that pass through them: the joists are composed each of two cheeks, a foot in depth and 3 inches thick, separated at intervals by four blocks of wood of the same height and thickness, all firmly put together with bolts, screws, and nuts: two cleats are nailed to each end of the joist on their under sides, whose ends fit flat against the girder and keep all steady.

"Planks, 16 feet in length, running longitudinally, each plank stretching over three paces, and regularly disposed as to their joints, are spiked down on the joists: in a direction across these, and upon them other planks are spiked down, their lengths being the same as the breadth of the platform. The planks are all embedded in a composition of resin boiled in linseed oil, which in laying on is mixed with ashes. The lower planks are three and the upper ones 3½ inches thick; they are only six inches broad to prevent warping, and have two strong square-headed spikes passing through them near their edges at every crossing of the upper over the lower planks: their joints are clinched below the platform, to accomplish which 16,370 spikes weighing a ton and a half were used; thus the platform has been rendered extremely strong and firm.

"The better to secure the sides of the platform and ends of the timbers from the weather, a cornice or moulding of wood is nailed along the outside.

"The hand-rail is trussed, and consists of iron pillars or stanchions; diagonal braces of iron, and a stout wooden rail running from end to end of the platform: the whole put together with screws and nuts, and adjusting screws for setting up or tightening the diagonal braces whenever required. (Fig. 10).

"The rise in the platform is as before stated, 9 inches, but the curve of the hand-rail is only 3 inches; to effect which, the stanchions which support the rail are of varying lengths, the rail being 4 feet 6 inches above the platform at its connection with the masonry, but only 4 feet in the centre of the bridge."

The following are the weights of the chains, rods, and materials of the platform:—

	Iron. Tons.	Wood. Tons.	Tons.
6 double main chains, joists, and bolts	8·5		
74 vertical rods with joints, bolts, &c.	1·385		
Flat bars and bolts	1·726		
37 double joists, blocks, cleats, &c.		6·190	
Bolts, nuts, screws, stanchion plates, flat rings, &c. &c. from beams	0·383		
Planking 1,124 cubic feet sal wood		27,000	
Carried forward	11,994	33,190	

	Iron. Tons.	Wood. Tons.	Tons.
Brought forward	11.994	33.190	
Iron spikes 16,370 for planking	1·467		
Iron railing trussed, screws, nuts, &c.	1·314		
Wood for the hand-rail, 52 cubic feet.........		1·479	
376 feet of cornice to the platform		1·531	
Composition of resin and oil	14,775	36,200	50,976
Total weight hung between pillars			1,745
		Tons....	52,720

ELECTRO-VEGETATION.

Letter IV.

Sir,—We propose next to consider how far the operations of *light* on vegetation are referable to electrical agency. *Light extracts moisture in great abundance, and oxygen in degrees proportioned to the quantity of carbonic acid present in the atmosphere from the under surfaces of the leaves when their vegetation is vigorous.* It has been supposed that the moisture exhaled from plants bears a near analogy to the perspiration of animals, and might in like manner be promoted by exposure to heat in the absence of light. It appears, however, to be a process altogether dependent on the action of light; for if two plants be placed under the sun's rays, the one open to their action, the other with an opaque covering, which, while it excludes their light, admits their heat in an equal or greater degree, a glass vessel being placed over both for the purpose of receiving moisture, the first will be quickly suffused with pure water standing in drops, while the latter will remain perfectly dry. This exhalation, therefore, is not a result of any internal process passing in plants, by which heat is generated within them and thrown off in the form of vapour, but is the pure action of the light combining with the aqueous particles of the sap, and transforming them into gas. It proceeds from the under surface of the leaf, which in general is more porous and less resinous and polished than the upper surface; a fact which may be observed by inverting two glass vessels, the one on the back, and the other on the face of a leaf; the first, if exposed to the sun, will be quickly suffused with moisture, while the other will receive no moisture whatever. This extraction of one of the elements of the sap *by the pure agency of light* abstracted from heat, bears a strong analogy to that of electricity; and indicates that this is the principle by which the decomposition is effected; which though partial, as not being sufficiently intense to resolve the water into its elements, is yet the result of such a degree of electric influence as is requisite for the occasion, rendering the sap more dense for its descending course, and removing many of those aqueous particles which by conducing to its fluidity and levity, greatly aided in its ascending direction.

Oxygen gas is now well known to be extracted from the leaves of plants by the agency of light. Of this fact I have satisfied myself, by observing that the production and increase of gas in glass vessels inverted over fresh leaves merged in water, depended wholly on their exposure to the light. In my experiments the increase was slow, in consequence of my not being aware at the time of the necessity of the presence of carbonic acid in the water to the production of the oxygen. I, however, found that the gas thus procured was pure oxygen, which, though slightly diminished during the night season, upon the whole furnished me with a sufficient supply for a satisfactory experiment, proving it to be oxygen in a state of purity. My indefatigable friend, Mr. Weekes, has arrived at the same conclusion, by experiments made by means of his newly-invented pneumatic apparatus, described in your pages, on plants while remaining in air as their natural element. But I do not know whether he was aware, or is prepared to admit, the necessary presence of carbonic acid in the atmosphere, in order to the production of oxygen, which, however, appears in several very decisive experiments of Sir H. Davy, related in his Elements of Chemistry; and is confirmed by Woodhouse, who "drew from his ex-

periments the conclusion that the change produced by the vital action of the vegetable, excited by solar light, is the decomposition of carbonic acid, and consequent evolution of oxygen." Heat, in the absence of light, is known to be wholly inefficient in the production of this process. We have, then, in this case, an evidence of several chemical effects to which light, as distinguished from heat, is essential;—the decomposition of carbonic acid, attended probably with a deposition of the carbon in the leaf, or its union with some other substance contained in it, [and the extraction of its oxygen, which probably, by entering into combination with the particles of light, escapes in the form of gas. Is it not reasonable to conclude, that the agent in the production of these chemical changes is identified with the electric fluid; and that thus the solar beams, instead of accumulating in the atmosphere in the form of electricity, and generating storms or hurricanes, are converted into the means of maintaining the vital principle in animals? By this means one portion of that fluid, which is so copiously dispensed from the sun in the summer season, may be conceived as being both neutralized, or prevented from proving the occasion of much disorder and injury in the system of nature,—and converted into the great essential of animal vitality; while a much larger portion is neutralized by a similar combination with the particles of water, and by forming clouds and rain, both mitigates the heat, and again imparts nurture to vegetation.

These rays, if suffered to float in the atmosphere without entering into these combinations, would either derange the harmony of nature by electrical concussions far exceeding any which fall under our experience, or by rarifying and raising the temperature of the atmosphere in the like unexampled and intolerable degrees, render it in these respects, as well as by the probable absence of oxygen, unfit for the purposes of animal existence.

The following experiment will serve to show the necessary presence of carbonic acid in an atmosphere of *water* to the production of oxygen gas. Some water, out of which the air had been boiled exhibited no gas from a sprig of vine-leaves exposed to the sun's rays; but on being impregnated with carbonic acid, and placed in the same circumstances, large and copious globules appeared on the back of the leaves; and on burning a taper in the gas collected from them, the light was extremely brilliant. This experiment has been repeated in the presence of several persons who were fully satisfied with the result. By many trials I also find that in proportion as the oxygen gas is produced, rhe carbonic acid disappears from the water, and indeed that it is withdrawn from it by the action of the leaves in the absence of light, and during the night season, though no oxygen is produced but on exposure to the solar rays. Having placed a fresh leaf in some pump water which I had found to yield globules to fresh leaves freely when exposed to light, and excluded the light from them for about an hour, I was surprised to observe that on removing the covering, and suffering the leaf and water which had been in darkness to remain a considerable time under the beams of the sun, no globules whatever appeared; and from subsequent observations on sprigs of leaves in jars of the same water, I discovered that the carbonic acid was as completely removed by the action of the leaves, though remaining in total darkness, as if it had been expelled by boiling; no globules appearing in the jars of water which had been confined with sprigs of vine-leaves for about ten hours, provided those leaves were removed and fresh leaves were introduced: whereas when the same leaves remained in it, which, on being wetted by lime water, remained transparent, they, after having been exposed a few hours to the light, began to yield globules; showing that having imbibed the carbonic acid while in darkness, they now yielded its oxygen from the pores under the action of light.

That solar light extracts oxygen from "the leaves of plants, their green shoots or branches, or even the entire vegetable under water," was the observation of Ingenhouz; and he found also that "its production was considerably dependant on the nature of the water under which the vegetable was immersed. It has been since shown by the experiments of Sennibier, Woodhouse, and Saussure, that it is much connected with the presence of carbonic acid; so that in water entirely free from this, the evolution of oxygen gas is very inconsiderable, while in water impregnated with it it is abundant. It may be inferred, therefore, that it is

principally from the decomposition of the carbonic acid by the pores of the plant, aided by the agency of the light, that the oxygen is evolved."* Here are strong confirmations of the principal facts which I have adduced, excepting that these distinguished philosophers appear to have been of opinion that a small portion of the oxygen might proceed from the plant itself in a more direct manner; and that they make no mention of the action of the leaves, by imbibing the carbonic acid in the absence of light. As this particular, being new and wholly unanticipated by me, strongly attracted my attention, I repeated my observations with care, and can entertain no doubt whatever of the fact. I cannot help regarding it as a very satisfactory evidence of the useful operation of plants during the night season, if we admit that they exercise the same function of attaching carbonic acid to their substance under their ordinary circumstances surrounded by air, which they manifest when immersed in water. That they do exercise this function in air, appears from the experiments of Davy and Woodhouse, above alluded to; and as it is probable that a function which appears to be natural to them is exerted with the greatest perfection in their proper element, it seems reasonable to conclude that they are very operative in removing from the atmosphere the deleterious gas which is exhaled from the lungs of animals, by night as well as by day, although they are indebted to the assistance of solar light in evolving the oxygen from the carbon, which now enters permanently into their substance.

Mr. Weekes informs me, as one of the results of his experiments with his new pneumatic apparatus, that healthy plants do yield carbonic acid occasionally, but not in sufficient quantities to affect the conclusion that oxygen gas is their general aerial produce. It has been the opinion of some physiologists that they absorb oxygen, and give out carbonic acid during night. I admit that the oxygen which has been given out during the day sustains some diminution in the night, when the experiment is made over water with the leaves immerged in it; but this is probably to be ascribed to the absorption of the water. It evidently requires a due regard to proportions in introducing carbonic acid to the action of plants. From one of my experiments, it appeared that two vine-sprigs, each with several leaves in a jar of water from which the air had been withdrawn by the previous action of leaves in it, became beautifully illumined with globules of oxygen, by introducing about one-fourth of its bulk of carbonic acid into the water. Hence it is probable that a very small proportion of this gas diffused through the air is best suited to the absorbent property of the plants; and perhaps that minute proportion in which it is ordinarily found in the atmosphere, is that which is best suited for their action in that element. Priestley found that when mixed with it in the proportions of from one-half to one-eighth, the plant confined in this mixed atmosphere was almost instantly destroyed; and I have found the leaves apparently injured by too large proportions of the gas in water, under which circumstances it is highly probable that they occasionally give out a portion of it unaltered, especially when kept beyond their natural or ordinary time in darkness. The results, however, which have fallen under my observation are such as I have above stated; the leaves appearing to attract the carbonic acid from the surrounding medium at all hours, in darkness as well as in the light, and yielding its oxygen under the influence of the solar rays.

One inference follows from the fact, that the production of oxygen gas from the leaves of plants depends on the presence of carbonic acid in the surrounding medium, which I would hope may prove of some practical utility. Carbonic acid can be procured with considerably more facility than oxygen gas in the ordinary methods; but by impregnating water, containing branches of leaves exposed to the solar rays, with the former of these gases, the latter might be obtained in quantities sufficient for several purposes; as for the recovery of suspended animation in the cases of still-born children, of drowning or other medicinal uses, by being kept in glass bottles well sealed. At any rate, an attention to the requisite quantity of the aerial acid in the water in which vegetables are immersed in order to obtain oxygen gas from them will greatly facilitate success, without which the mere addition of fresh leaves to the water would prove almost wholly un-

* See Murray's Chemistry, vol. ii. p. 288, &c.

availing; whereas their under surfaces will speedily become finely bedecked with large globules of oxygen, when the water has been impregnated with about one fourth of its bulk of carbonic acid. It will probably occur to the recollection of some of your readers, that "the lady of a physician having a child still-born, all the common means were tried without effect. Recollecting he had a bladder of vital air, with which he was about to make an experiment, the doctor forced this air into the lungs of the infant, when the eddies of its little heart began to play, and the child was restored." Mr. Weekes informed me, that "he had several times *actually used* oxygen in cases of suspended animation, and with success; and that in the last instance, he had recovered a boy, who was then living four years after, when he had been twenty minutes under water. I find," he adds, "the best method, because the simplest, is to pass an elastic tube into the windpipe, and then inflate the lungs by having the gas *diluted* with one-third atmospheric air, in bladders ready to attach to the pipe." I have ventured to trespass from the proper object of this paper with these remarks on the means of obtaining oxygen, and this important practical application of the gas, particularly by my friend, in the hope of their conducing to some future usefulness—wishing to obtain all the light and information in my power upon the subject of the electric relations of the *soil* to vegetation, and the influences of the solar fluid in its connexion with it. I must here close this letter.

I remain, Sir,

Yours respectfully,

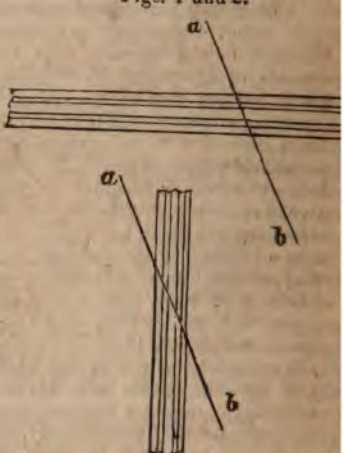
T. PINE.

KIRKBY SLATE QUARRIES.

Sir,—In a former paper on this subject, amongst other circumstances I endeavoured to describe the distinctions between what are called *back* and *foot* quarries; and at that time supposing the plane of cleavage to have some determinate angle with respect to the plane of the stripes, I described the peculiar motion that must have taken place to change the one into the position of the other; I had observed for example, that fig. 1 represents the section of a *foot* on a vertical north and south plane, and *a b* the direction of the plane of cleavage in that *foot* dipping to the south: and that f represents the section of a *back*, al a vertical north and south plane, *ab*, h here also the direction of the clea dipping to the south.

Now it will be manifest that if f be put into the position of fig. 1 the indicating the cleavage in each, will in contrary directions:—and supposi change had taken place in the positi the rock, I could then only accoun the dip of the cleavage in both back feet being to the south, by supposing one had actually turned round in manner I have described, and whi may further illustrate by stating that i 2 be drawn on the other side of the s paper on which fig. 1 is placed, and both figs. 1 and 2 be then examine looking through the paper, the dip of clevage, (the plane of stripes bein the same direction) will then be in same direction in both.

Figs. 1 and 2.



These appearances had been obser in so many extensive quarries, and h near and at such distances from e other as to have fixed the terms *backs* a *feet*, as the means by which those gaged in or about the quarries dist guished the position of the rock quarries which differed from each ot I had notwithstanding noticed that angle which the cleavage makes with stripes was more oblique in the *ba* than in the *feet*, but this was not suffici to lead me to expect so extraordinar fact as the following.—

In a recent extension of a quarry, formerly called a *foot*quarry, the connection between the appearance called *feet* with that called *backs*, represented on a north and south vertical plane, was observed to be as in fig. 3. The several

Fig. 3.

ab^1s being the direction of the cleavage, and all parallel or nearly parallel to each other, dipping to the south; and, indeed, as well as in all other quarries which have been observed, with a bearing very nearly magnetic, east and west. It therefore appears clearly from this, that the cleavage can be in no way regulated by what appears to have been originally the strata of the slate rock material, as indicated by the stripes, and the great joints parallel thereto. Since this was observed, indications in other quarries have been perceived, from which it may be inferred that a like connection between the *feet* and the *backs* may ultimately be traced.

From these and other appearances, perhaps it may be inferred that the slate rock material was once in a plastic state, and that the property of cleavage occurred subsequently to the period when the mass obtained the position in which it is now found.

In some of the feet an appearance has been observed as if the material in the plane of the stripes had moved while in a plastic or disunited state. This will perhaps be better understood by supposing a number of quires of paper, say, alternately a quire of plain and a quire of gilt edged—and the gilt or plain having moved, they project one before the other, not *unlike what in building* is called lafer-boarding, or in ship building clinker built. When in this state the rock became united and hardened.

The direction of the cleavage in some of the *feet* just alluded to is a little changed, although the general cleavage of a large block may be very nearly a plane, yet at every stripe a slight deviation takes place, forming a ridge. The material of the stripes is not only of a finer texture, but it is something harder than the other parts of the slate rock.

The cleavage is also in some places altered by the nodules, and the occurrence of other harder or different material by which a carved and uneven surface is produced. The largest nodules that have been observed, are 2 feet long, 16 inches

Fig. 4.

Fig. 5.

broad, and 9 thick, with an appearance similar to the sketches, figs. 4 and 5; the transverse section being oval. The nodules are striped like the ordinary slate material in which they are found embeded; but they are either much harder than the slate, or otherwise they are as soft, and not unlike generally brown rotton stone. Indeed, one of the large nodules alluded to was partly sound and partly rotten. There is no reason, however, to suppose that the hard parts would, by exposure to the atmosphere for any known length of time, become soft.

Side Seams.

Besides the joints which are parrallel to the stripes, there are others which cross them. The greatest of these are called *side seams*, the bearing of which is nearly north and south, and the dip at a very considerable angle to the east. Where-ever a side seam has been discovered, it has been found to extend through all the feet or backs as far as the quarries have been wrought; so the extent of these joints is not known. These joints have been observed to have nearly the same direction in both back and feet quarries. The distance they are apart in some places is not more than 20 feet, while in others, they are much more, and in some extensive quarries no side seams have yet been discerned. Some side seams are nearly planes, others differ from them in degree of roughness and irregularity, as well as in the material in the joints. It has been remarked by the workmen that when the side seams are the nearest to a plane, the cleavage also presents the evenest surface. This is remarkable as the plane of cleavage crosses the plane of the side seams.

Ends.

Each foot and back, or whatever other position the stripes or strata of the rock may have, are crossed by seams or joints called *ends*, the bearing of which is nearly north and south, or the same as the side seams, but the dip is generally nearer vertical. In some feet and backs the end joints are very close to each other; but in those which produce the largest material, they are at a much greater distance. One part of the same foot or back frequently contains more of these end joints than are found in an equal portion of another part. These end joints in a foot or back not only do not continue through into the adjoining feet or backs, but frequently they only extend a little distance into the rock forming the foot or back, when they terminate. Some of these joints are by the workmen called saw-gates, and indeed they very much resemble the cut made by a saw in any material; the sides of the joints being parallel, and terminating as abruptly in the solid material as a saw-kerf in a plank, block of wood, or any other substance. Sometimes these joints are so close as not to be perceptible, and when they terminate, the workmen say the rock is grown together.

Clog-Heads.

The joints, so called, have an east and west bearing, or nearly so, and cross the back and feet at different angles of dip. This term appears only to describe the top or uppermost bed, and consequently, is less appropriate than some of the other terms. When speaking of the lower bed of such a joint, the workmen say it came off at a clog-head.

Diagonal Joints.

These are called slipes by the workmen. If the bearing of a diagonal joint is the same as the ends, it is then called a sliping-end; if in the direction of the clog-head, then it is called a sliping clog-head.

Each joint is further distinguished by the term wet or dry—close or open—rough or smooth—brown, blue, sparry—or according to any other material that may be in the joint.

Rambles or Veins.

These are nearly vertical, and their bearing varies from nearly north and south to north-east and south-west. These cross the direction of all the joints, and divide the slate back. Several of these have been observed at about 100 feet distance from each other.

One of these veins, which has been more particularly noticed, is about two feet thick; and the corresponding feet on the east side are between two and three feet lower than those on the west side of the vein. Thus, either the rock has been raised on one side of the vein, or on the other side it has sunk.

From the constant observation of the workmen, they find that the slate-rock, if not rendered quite useless, or poisoned, as they term it, by being near these ram-

bles, it contains a greater number of joints there than is found at a greater distance from those places.

Hoping that I have described with accuracy, if not in geological terms, the several appearances *to which I have alluded in these quarries,* and that your readers, generally, will be able to understand what I have written,

I am, Sir,

Your obedient servant,

JOSEPH JOPLING.

THE NEW SAFETY-CAB.

Public attention has been a good deal attracted by a carriage, built by the Safety Cabriolet Company, after Mr. Hansom's patent, as a specimen of those intended to be introduced into the streets of the metropolis. We are gratified to hear that the plan has been found to fulfil, if not exceed, the expectations of the inventor, and of the Company. For ease and safety to the passenger, it is unequalled; and for lightness of draught to the horse, far superior to any other vehicle yet invented. The position of the driver (on the top of the carriage) has been objected to as unsafe; but the men who have been engaged in this capacity are of quite a contrary opinion, in which we certainly agree: for facility of steering, it cannot be compared with the awkward one-sided position of the driver of the common cab; being elevated, the guide has a clear view of all around him, and can observe the signs of the drivers in the van without obstruction,—a point of great importance in such crowded thoroughfares as Gracechurch-street, Cheapside, Fleet-street, and the Strand—the principal courses of cab-traffic. The safety and utility of the invention having been fully proved on the experimental carriages, by severer trials than it is ever likely a cab in ordinary use would be subjected to, the company are now building a number, to supersede the present dangerous and lumbering things—which will be in full operation about the latter end of May. It is almost needless to wish the undertaking success, we are confident the invention will mutually benefit the public, the shareholders, and the talented inventor.

PROVINCIAL INSTITUTIONS, LIBRARIES, AND MUSEUMS.

Sir,—I now proceed to fulfil my promise as to the "public and permanent" provincial Institutions, most of which I find, upon further inquiry, have already been "recognised by the Government." In 1822, the Record Commission determined to transmit to each of the following Institutions (except those marked with an asterisk, which I have added to the list) a copy of every work published by them, on condition that they should be accessible to any person without difficulty; and the value of such books, including others given to other public libraries and to individuals, was stated in 1833 to exceed the sum of 35,000*l.*! Man of the libraries in the subsequent enumeration are public *endowed* Institutions; while others are "permanent," from the circumstance of their possessing vested funds sufficient to protect them from any chance of dissolution:—

Aberbrothock Subscription Library.
Aberdeen; Advocates' Library.
Alnwick Subscription Library.
Ashby-de-la-Zouch Public Library.
Bath Institution.
Belfast Literary Society.
Birmingham Library.
Bolton-le-Moors Public Library.
Boston Permanent Library.
Bristol Library Society.
Burslem Subscription Library.
Cambridge Philosophical Society.
Canterbury Philosophical and Literary Institution.
*——— Museum.
Cork Royal Institution.
Coventry Subscription Library.
Cupar, Fife, Public Library.
Devon and Exeter Institution.
Doncaster Subscription Library.
Dublin Library Society.
Dublin Royal Society.
*——— Museum.
Dundee Public Library.
Edinburgh; Library of Writers to the Signet.
Eton College Public Library.
*Glasgow Museum.
Gloucester Permanent Library.
Greenock Public Library.
Halifax Literary and Philosophical Society.
*Henley-upon-Thames; Dr. Aldrich's Library.

Hull Subscription Library.
Ipswich Corporation Library, for the use of the county of Suffolk.
Leeds Subscription Library.
*Leicester Public Library.
Liverpool Lyceum Library.
——— Royal Institution.
*——— Museum.
Maldon; Dr. Plume's Public Library.
Manchester; the Cheetham Public Library.
——— Portico Library.
*——— Museum of the Zoological Society.
Montrose Public Library.
Morpeth Public Library.
Newark Stock Library.
*Newcastle-upon-Tyne; Dr. Tomlinson's Public Library.
——— Literary and Philosophical Society; possessing a MUSEUM, containing the finest collection of British birds in the kingdom.
Norwich Public Library.
*——— Literary Institution.
*——— Museum.
Nottingham Subscription Library.
Penzance Subscription Library.
Reading Literary Institution.
Royston Subscription Library.
Scarborough Subscription Library.
*——— Museum.
Strond Institution.
Sunderland Literary and Philosophical Institution.
Taunton, Somerset, and Taunton Institution.
Wight, Isle of, Institution, at Newport.
Yarmouth Public Library.
York Subscription Library.
*—— Museum.

The Record Commission having set so good an example, why should the Trustees of the British Museum refuse to follow it? What objection can be raised to such an appropriation of a part of the 3,570 volumes of their *own publications* now remaining in store; to say nothing of the continual accumulation of other printed books, prints, coins, and objects of natural history? If it were not considered advisable to admit the whole of the Institutions I have enumerated to partake of this valuable privilege, a selection might be made of the endowed and public and permanent ones. The different Provincial "MUSEUMS" would be greatly benefited by a share of the duplicate objects of natural history, coins, and prints.

Although I may differ with your correspondent, P. P. C. R., on the expediency of an "Evening Reading-Room," I consider his suggestion as to the exhibition of the coins (at least, of a part of them) as extremely valuable, and worthy of immediate adoption. There are duplicates enough, I understand, to allow of this plan, without disturbing the continuity of the general collection. Some of the 20,000 MSS. might be exhibited under glass-cases; and a complete series of autographs of the kings of England, as well as MSS., with illuminations, from the earliest to the latest period, might be shown in this way. Something of this kind is done in the Royal Library at Paris; why not in the British Museum?

I am, Sir, yours, &c.

S. S.

P. S—Any further hints or suggestions from your valuable correspondent, P. P. C. R., would, I think, be particularly acceptable at the present moment, as the Committee of Inquiry are still pursuing their labours; and you, Sir, will confer a lasting benefit upon the public by devoting occasionally some pages of your widely-circulating Journal to subjects so intimately connected with its best interests—the promotion of the cause of science and knowledge. I cordially agree with P. P. C. R. in his excellent observations on the very imperfect and unsatisfactory article in the *Penny Cyclopædia*. Perhaps he does not know that Sir HENRY ELLIS is one of the COMMITTEE of the Society for the Diffusion of Useful Knowledge; but can the information in this article be entitled to such an epithet? To P. P. C. R. I would say, as it respects the present inquiry, *unita vis fortior*, and in future, if on some subjects we "agree to differ," may we "differ to agree" on the principal one, "the necessity for an entire reform in every thing connected with the British Museum!"—S. S.

ANALYTICAL NOTICES OF RECENT SPECIFICATIONS.

THOMAS WALKER, *of Burslem, Mechanic; Improvements in Extinguishers*

to Candles, and in the Application of such Extinguishers to Candles and Candlesticks.—Patent sealed July 3, specification inrolled Sept. 1835.

After this rigmarole title, it may be necessary to explain, that this patent is for a self-acting extinguisher. There is no improvement in the extinguisher itself as the title states; there is the self-same cone as has been used from time immemorial by every member of the *save-all* club; the improvement consists merely in an apparatus connected with the extinguisher and candlestick, which puts out the light after a given length of time has passed, or rather a given length of candle is consumed. The candlestick consists of a tube, covering the whole candle, which is inclosed therein with a cap, having a hole for the wick. A spiral spring in the tube under the candle continually presses it upwards against the cap, the same as in the carriage-lantern. The patented improvement in the apparatus consists in attaching to the top of the candlestick an extinguisher, turning on a pivot and arm, to which is given a tendency always to close on the candle by a spring coiled on the pivot. The extinguisher is held back by a catch, which communicates with a lever, having a chain and pin attached to it. There is a slit in the upper portion of the tube which is graduated with a scale of the hours and minutes the candle will burn. The pin is thrust through the candle at the required time it is wanted to burn indicated by the scale; and as the candle consumes, the pin rises till it comes in contact with the lever, releases the catch, and lets the extinguisher down upon the light.

The accuracy of the action of this machine, it will be seen, depends entirely upon equal portions of the candle being consumed in equal periods of time. All that can be effected is, an approximation to the desired measure of duration, which will be more or less near, as the candle is of equal quality throughout, and burnt in a situation free from draft or change of temperature. With respect to neatness this patent extinguisher is superior, but in utility only equal, to the simple self-acting one which has been in use for years, which acts by its own gravity, being released by the candle having burnt down to a pin which supports it.

James Kean, *of Johnston, Renfrew, Machine-maker and Engineer; Improved Throstle-Flyer, or a Substitute for an ordinary Flyer, employed in Spinning Cotton, Flax, Hemp, Wool, Silk, and other Fibrous Substances.*—Patent sealed July 3, 1835, inrolled Jan. 3, 1836.

The patentee substitutes for the common forked-flyer a cylinder of thin sheet brass, copper, or tin, open at one end, and covering the bobbin. By this arrangement he says, that a swifter revolution will be made by the bobbin with the same power, or an equal swiftness with a smaller power; because at present the atmosphere greatly retards the speed of the bobbin, and the cylindrical flyer excluding the atmosphere, will allow the bobbin an unimpeded course. The exclusion of the air would certainly facilitate the speed of the bobbin; but the disadvantage is, that it will be difficult to get at the bobbin when the thread breaks to find the end and join it. The utmost facility should be given for this operation in spinning, which is of momentary occurrence, and the provision made by the patentee we do not think sufficient to obviate the objection. The cylindrical must, we should think, be heavier than the forked-flyer, and this will consume a portion of the power saved; and a greater speed than is at present attainable is unnecessary, as it would cause an even more frequent recurrence of the before-mentioned disadvantage, that is, mending a broken thread.

William Busk, *of Bankside, Surrey, Engineer; Improvements in Propelling Boats, Ships, or other Floating Bodies.*—Patent sealed July 10, 1835; specification inrolled, Jan. 10, 1836.

This invention consists in the application of the principle of Barker's mill to the propulsion of vessels. Water is pumped by a steam-engine into a tank, which is connected with trunks projecting over each side of the vessel. Each side of these trunks at right angles with the side of the vessel is provided with a sluice-gate; and the water being kept by the steam-engine always at the same level in the tank, has an equal pressure on every side of the trunk except where it is allowed to escape by the sluice; consequently, if the hind sluices be opened, the egress of the water that way will have a retroactive force on the trunks, and

propel the vessel forward. A retrograde movement may be effected by shutting the hind sluices, and opening those forward: the vessel may also be made to turn by opening and shutting the sluices on either side: this, the patentee states will be of great advantage, when the ship may by accident lose its rudder. The power is proposed to be regulated by the height of the head of water, and the opening of the sluice gates more or less. Mr. Busk goes into details as to regulating the head of the water in the tank, and enters into a number of calculations as to the power and capabilities of his invention, through which we will not follow him. The principle of Barker's mill is a very valuable one, where it can be applied with an already existing head of water; but when that head has to be pumped up by a steam engine, there is anything rather than a saving of power. A steam engine on board a vessel would be more economically employed turning paddle-wheels, than pumping water into a tank to obtain a retroactive force from its flowing out again. The constant suction, too, of the powerful pumps which would be necessary, at the bottom of the vessel, would be a great impediment to its progress.

John Rogers, *of Princes Street, Westminster, Gent.; Improvements in Paddle Wheels.*—Sealed July 10, 1835, specification inrolled January 9, 1836.

We have seldom seen a more absurd and cumbrous piece of mechanism than Mr. Rogers has thought proper to obtain a *legal* monopoly for; a virtual monopoly he might have kept undisturbed possession of, without being at the expense and trouble of a patent. Rogers' paddle consists of three rings or rims, the two outer of equal diameter, the middle one somewhat larger. To the outer rims are bolted the sides of one series of float boards, which very much resemble a rather broad coal scuttle with the bottom out; under these, and attached to the large middle rim, are another series of flat boards in shape like a coal-heaver's shovel with a hole near the broadest end for the water to run out of, after passing the point of deepest immersion. The object of this second series of float boards, says the patentee, is to catch the water, after it has been acted upon, and passes from the coal-scuttle shaped paddle. There is also a third series of paddles, which are denominated "bat-wing paddles," being of that shape, which are placed at an angle between the inside of the large rim, and the outsides of the two outward smaller rims. The object of this combination of float boards or paddles, is stated to be to obtain a large resisting surface to the water, but so diffused and so arranged, that it shall enter and emerge from the water in the most beneficial manner for the propulsion of the vessel. After this description, we think we need hardly take up the time of our readers with any remarks upon this *valuable* patent. We shall just mention that the patentee claims as his invention, besides the peculiar arrangement of resisting surface, the placing a larger, or middle rim to a wheel, with separate paddles which shall have a deeper immersion than the others.

Rev. F. H. Maberly, *of Bourn, Cambridge; new method of Propelling Vessels.*—Sealed July 13, 1835, specification inrolled January 13, 1836.

Our readers will hardly believe that the learned clerical patentee now under our notice, has been at the expense of patenting a Windmill ship!—not of any peculiar construction—not with any contrivance to do away with the objections over and over again advanced—but a mere transposition of a common windmill from land to ship-board, and the substitution of paddle-wheels for millstones! This is not the first by some score, of such plans—not a few of them have been noticed too in our own pages—and there was one described in vol. xvi. p. 35, far more worthy of a patent than the reverend gentleman's. We now turn to the paddles which are to be set in motion by the windmill. The float boards are affixed to an endless chain which works round two wheels placed a little distance apart from each other, along the side of the vessel. We hardly recollect, amidst the confusion of words in the specification, whether both the upper and under parts of the chain are to be continually under water, but we imagine it must be so, because after the paddles opposing their surface to the water, in passing with the chain under the two wheels, they are "struck," (as the patentee terms it) by entering a groove, which carries them

along the upper side in a horizontal direction. We beg again to refer our reverend friend to our 5th volume, page 137, where he will find this part of his invention described.

We fear our patentee has been seized with a species of monomania, as we observe that he has since taken out another patent, for a Street-sweeping machine! That he is under a delusion, and believes himself that the inventions are really worth something, we can easily imagine; the very fact of his throwing away a few "cool hundreds" on patents is a proof of this. The inventor, as well as the poet, should know what ideas have been made public before his time, so that he may avoid republishing antiquities. Mr. M's. windmill has brought "grist to the mills" of the different offices through which a patent has to pass; but will bring none to his own.

After what we have said, it would be absurd to criticise the drawing of the specification;—we will just observe that the word "new" in the title, should be altered to "old and useless." Both the description and the drawings are evidently the productions of the reverend gentleman himself, with a bad pen, and without rule or compass. If he cannot preach a sermon better than he can draw a specification, we pity the unfortunate congregation of Bourn.

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 21st OF MARCH, AND 21st OF APRIL, 1836, INCLUSIVE.

Luke Hebert, of Paternoster-row, civil-engineer, for certain improvements in mills or machines for grinding and sifting farinaceous and other substances. Sealed March 23.

John Brunton, of West Bromwich, Stafford, engineer, for certain improvements in the construction of retorts for generating gas for the purpose of illumination. March 25.

Miles Berry, of Chancery-lane, in consequence of a communication made to him by a certain foreigner residing abroad, for a certain improvement or certain improvements in the system or mode, or method of working engines for exerting mechanical power. April 6.

Joseph Chesseborough Dyer, of Manchester, machine-maker, and James Smith, of Deanstone, Perth, cotton-spinner, for certain improvements in machinery used for winding upon spools, bobbins, or barrels, slivers or rovings of cotton, wool, and other fibrous substances of the like nature. April 7.

William Hale, of Greenwich, Kent, late of Colchester, Essex, civil-engineer, for certain improvements in machinery applicable to vessels propelled by steam or other power; which improvements or parts thereof are applicable to other useful purposes. April 11.

John Birkby, late of High Town, but now of Upper Rawfolds, both of Liversedge, near Leeds, card-maker, for improvements in machinery for making needles. April 11.

Frederick Chaplin, of Bishop Storford, Herts, tanner, for an improvement in tanning hides and skins of certain descriptions. April 11.

Charles de Bergue, of Clapham Rise, Surrey, engineer, for certain improvements in machinery used for spinning and doubling yarn or thread manufactured from cotton or other fibrous material. April 11.

Frederick Edward Harvey, of the Horseley Iron-works, Tipton, Stafford, mechanical draftsman, and Jeremiah Brown, of Tipton, roll-turner, for certain improvements in the process and machinery for manufacturing metallic tubes, and also in the process or machinery for forging and rolling metal for other purposes. April 22.

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 22nd OF MARCH AND 28th OF APRIL, 1836.

William Gossage, of Stoke Prior, Worcester, chemist, and Edward White Benson, of Wichbold in the same county, chemist, for an improvement or, improvements in the process of making or manufacturing ceruse or white lead. March 29; six months to specify.

James Noble, the elder, of Mill-place, Commercial-road, woolcomber, for certain improvements in the combing of wool and other fibrous substances. March 29; six months.

Charles de Bergue, of Clapham Rise, Surrey, engineer, for certain improvements in machinery used for spinning and doubling yarn or thread manufactured from cotton or other fibrous material. March 29; six months.

William Brindley, of Caroline-street, Birmingham, paper-maker, for improvements in the manufacture of tea-trays and other japanned ware, and in the board or material used therein, and for other purposes. March 29; six months.

Thomas Cockerell Hogan, of Castle-street, Holborn, hat-manufacturer, for certain improvements in hats, caps, and bonnets. March 29; six months.

Andrew Parkinson, of Low Moor, Lancaster, overlooker of power-looms, for an improved stretcher, to be used in, or with, hand or power-looms; being a communication from a foreigner residing abroad. March 29; six months.

Samuel Parlour, of Addiscombe-road, Croydon, Surrey, gentleman, for certain improvements applicable to sketching, drawing, or delineating. March 31; six months.

John Jeremiah Rubery, of Birmingham, umbrella and parasol furniture manufacturer, for certain improvements in the making or manufacturing umbrella and parasol stretches. April 7; six months.

John Spurgin, of Guildford-street, Russel-square, Doctor of Medicine, for a new or improved ladder or machinery applicable to the working of mines and other useful purposes. April 7; six months.

John Holmes, of Birmingham, Warwick, engineer, for certain improvements in the construction of boilers for steam engines. April 7; six months.

Thomas Ridgway Bridson, of Great Bolton, Lancaster, bleacher, for a certain improvement or im-

provements to facilitate and expedite the bleaching of linen and other vegetable fibres. April 7; six months.

Robert Copland, of Brunswick Crescent, Camberwell, Esquire, for improvements upon patents already obtained by him for combinations of apparatus for gaining power. April 9; six months.

Miles Berry, of Chancery-lane, civil engineer, for new or improved apparatus or mechanism for marking down or registering the notes played on the keys of piano-fortes, organs, or such other keyed musical instruments; being a communication from a foreigner residing abroad. April 7; six months.

Jacob Perkins, of Fleet-street, engineer, for certain improvements in steam-engines, and in generating steam and evaporating and boiling fluids for certain purposes. April 12; six months.

James Leman, of Lincoln's-Inn-Fields, gentleman, for improvements in making or manufacturing soap; being a communication from a foreigner residing abroad. April 12; six months.

Thomas Hodgson Leighton, of Blyth, Northumberland, chemist, for certain improvements in the converting sulphate of soda into the subcarbonate of soda or mineral alkali. April 12; six months.

Joshua Bates, of Bishopsgate-street, merchant, for certain improvements in machinery for cleaning and preparing wool; being a communication from a foreigner residing abroad. April 16; six months.

John Parkinson, of Rose Bank, Bury, Lancaster, calico-printer, for certain improvements in the art of block-printing. April 19; six months.

James Pedder, of Radford, Nottingham, lace-maker, for certain improvements in certain machinery for making, by means of such improvements, figured or ornamented bobbin-net lace. April 21; six months.

Henry William Nunn, of Newport, Isle of Wight, lace-manufacturer, for certain improvements in manufacturing or producing certain kinds of embroidered lace, parts of which improvements are applicable to other purposes. April 21; six months.

Hamer Stansfield, of Leeds, merchant, for machinery for a method of generating power, applicable to various useful purposes; being a communication from a foreigner residing abroad. April 23; six months.

Edward John Dent, of the Strand, chronometer-maker, for an improvement of the balance springs, and their adjustments of chronometers and other time-keepers. April 23; six months.

James Finlon, of Black-Horse-yard, Holborn, coach-smith, for improvements in apparatus for supplying water to water-closets. April 23; six months.

George Augustus Kollman, organist of his Majesty's German Chapel, St. James's Palace, for improvements in railways and in locomotive-carriages. April 23; six months.

Edward John Massey, of Liverpool, watch-maker, for improvements in railway and other locomotive-carriages. April 23; six months.

Simpson Mordan, of Castle-street, Finsbury-square, mechanist, for an improvement in making or manufacturing triple-pointed pens. April 23; six months.

William Taylor, of Smethwich, Stafford, engineer, and Henry Davies, of Stoke Prior, Worcester, engineer, for certain improvements in machinery or apparatus for introducing water and other fluids into steam-boilers or evaporating-vessels; also for obtaining mechanical power by the aid of steam, and for communicating motion to vessels floating in water. April 26; six months.

Thomas Aitken, of Edenfield, Bury, spinner and manufacturer, for certain improvements in the preparation of cotton and other fibrous substances, and in the conveyance of the same to roving frames, mules, throstles, or any other spinning or doubling machinery. April 26; six months.

William Preston, of Sunnyside, Lancaster, operative calico-printer, for certain improvements in printing of calico and other fabrics. April 28; six months.

NOTES AND NOTICES.

Greenwich Railway.—The newly invented break for stopping the train of carriages at a moments notice, was exhibited to Mr. Rennie, and several scientific gentlemen on Saturday last, as well as the carriages fitting up on Lord Dundonald's principle, with which they expressed themselves perfectly satisfied as to the impossibility of accident, or their upsetting.—*Sun.*

The Sea Water Purifying Company has been revived under new auspices. It is said that the process about to be adopted is founded partly on the patent of Mr. Wells, (which the Privy Council lately refused to confirm) and on a more recent invention of a Mr. Stothart. The object is an important one, and if Mr. Stothart's plan, (of which we know nothing) be effective, we wish its promoters success.

Case-Hardening.—It is perhaps not generally known amongst mechanics, that the salt called prussiate of potash is now much used in case-hardening. The process is easy, and saves a great length of time. The method is, to powder the salt and sprinkle it upon the iron when in a state of redness—it will run like oil; and when plunged into cold water, will be found as hard, or even harder than iron case-hardened in the usual way.

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C. E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

The communication of S. S. on the subject alluded to will be most acceptable.

Campo-Bello shall have early attention. He has ascribed the delay to its true cause.

Communications received from G. C. L.—Mr. Mackintosh—Mr. Steil—D. D. C.—Dr. Edwards—Clovis—A Cornubian—A Learner—Aug. Salvey—Mr. Murray—John Lee—A Utilitarian—M. M.—Ydlorey—Mr. Baddeley—A Friend to Railways, but Enemy to Quackery (which shall be forwarded as the writer requests)—A Visitor.

☞ Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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HEBERT'S PATENT DOMESTIC FLOUR-MAKER.

HEBERT'S PATENT FLOUR-MAKING MACHINE.

From a personal inspection of the machine delineated in perspective on the preceding page, and from a careful perusal of the inventor's specification, it appears to us to be his design to construct flour-mills of the utmost simplicity and durability; in which, not only the *grinding* of the corn, but the *dressing* (sifting) of the meal into flour, pollard, bran, &c., are simultaneously performed. It is not, however, to be understood that these combined operations are effected by the mere *annexation* of a dressing-machine to a mill, and driving them both together; for in such an arrangement there would be neither novelty nor economy. But the combined operations of grinding and dressing are in this new patent mechanism so simplified, and so intimate, that they are continuously going on, *upon one continuous surface*. The essential members of the machine are thereby reduced to only *two!* one stationary, the other rotative. This remarkable simplicity conduces to many advantages, which our mechanical readers will at once appreciate, without our entering upon the details. The inventor has shown in his specification, and has actually put into beneficial practice, several modifications of the principle so as to adapt the scale of their operations to any required magnitude. We have selected for the present article what the patentee denominates his patent *domestic* flour-maker, which is adapted to the manual force of one man; but the power requisite to work this, may be diminished or increased at the pleasure of the operator, by a corresponding reduction or augmentation of the *feed*, or quantity of corn permitted to pass under the operation of the grinders in a given time. In a subsequent Number we purpose inserting a description of one of the same kind of machines, which is in use at the workhouse of All Saints, near Hertford, where it is worked by any number of men, from two to ten (by a suitable alteration of the feed), and is capable of properly grinding and dressing as much corn in a given time as other mills will grind only; the estimated power required to work it efficiently, being that of one horse, whether worked by that animal, or by wind, water, or steam.

We shall now proceed to describe the hand-mill with reference to the engraving before adverted to.*

a is an axis, mounted in plummer-blocks *bb*, and turned by a winch *c*, assisted, if required, by a handle *d*, fixed to one of the arms of the fly-wheel *ee*. The axis *a* also carries a bevelled wheel *f*, which drives a pinion *g* fixed upon a vertical spindle *h*, that revolves in the centre of a metallic hopper *i*, and carries at its lower extremity the upper grinder; and to the periphery of the latter is attached a series of brushes, that revolve together with it inside the circular case *j*, cast in one piece with the hopper *i*. The lower grinder is fixed in the centre of the flat top *k* of the pedestal; and around the lower grinder, in the same plane as its superior surface, is an annulus of fine wire-gauze; over the area of which the brushes sweep in their revolution, continually scattering every particle of the meal, as the same is constantly projected in minute quantities all around the peripheries of the grinders, on to the wire-work; causing the flour to fall through the meshes into the drawer *mm* below: while the bran and pollard, which cannot pass the wire-gauze, are continually being freed from their adhering flour by the action of the brushes, until they are driven through an aperture, at the outer circumference of the wire-gauze, on to an inclined screen of coarse wire-work, where the offal separates itself, in the mere act of falling, into pollard and bran; both of which deposit themselves into separate compartments made in the drawer *n*. At *l* is a screw for regulating the admission of the corn; and at *o* is a lever, over an engraved plate, which directs the operator which way to move it, according as he may desire to regulate the grinding, whether coarser or finer than it was previously set. These adjustments are obvious to the sight, and unerring in their action.

Amongst the advantages which this machine presents to the economist may be stated its convenience, portability, and perfect cleanliness, and there being no dust or waste of any kind. It is particularly adapted for the use of domestic families who are desirous not merely to

* Our draftsman, upon looking at this engraving, has observed to us, that he has made the square pedestal or box rather too small, which has given to the machine an appearance of top-heaviness, which the original does not possess.

make their own bread, but to be sure that he flour which they use is a genuine product of good wheat. As respects its utility to emigrants and distant settlers, we have reason to believe that its merits have already been very satisfactorily tested; the durability of the grinding surfaces being such as to render a renewal of them apparently unnecessary for a series of years. A mill of this kind may be seen at No. 20, Paternoster-row.

IMPROVED PORTABLE FIRE-LADDERS.

Sir,—Mr. Merryweather having just completed a third set of his improved portable fire-ladders for the Fire-Association of the South-Western District of St. Pancras, the opportunity was taken of making some experiments, particularly with a view to ascertain the effect of my invention of an upper carriage, described at p. 184 of your 22d volume. In the first instance, a simple roller the width of the ladder was attached on the under side, and the relief which was thus afforded in raising the ladders was most surprising.

A pair of small wheels were subsequently applied, when all the irregularities of the brick-work, ridges, window-sills, &c., were surmounted with the greatest ease, and with a rapidity altogether unprecedented.

Thus equipped, three young men joined and raised *seven lengths of these ladders*, reaching upwards of 40 feet, *in half a minute!*

I was previously told that this feat had been repeatedly done on the day previous, but must confess I could not give credit to the statement; my scepticism was, however, completely removed on seeing the experiment performed.

There is one great advantage in employing wheels *permanently fixed* to the first joint of all such ladders as are *stationed in sets*, not yet adverted to, viz. that when the six ladders are strapped together, and standing upright against a wall, &c., with the wheels downwards, they serve to carry the ladders; and thus equipped, one man (supposing it possible a case may occur where no more assistance is at hand) can run off with them to the fire wi hout the least difficulty.

Another addition is about being made to these ladders, for the purpose of assisting such persons as, from fear or infirmity, are unable to avail themselves of the ladders as a mode of escape. A small metal pulley is to be fastened to the wheel-axle at the top of the ladder, a rope passed through which, enables a cradle to be raised to any window of a dwelling, for the rescue of invalids, females, children, &c.

It is with the most unfeigned pleasure, that I notice the attention which this subject has recently received; fire-escapes and improved fire-ladders have been stationed in numerous convenient, situations in many parts of the metropolis, and great exertions are every where making to lessen the number of those calamities, which, in spite of all human efforts, will sometimes occur.

I remain, Sir, yours respectfully,

WM. BADDELEY.

London, April 23, 1836.

ON TUNING PIANO-FORTES.

Sir,—Many, when they first commence learning to tune, are contented to begin simply with tuning, properly so called, instead of what is technically called roughing-up. This consists in taking the instrument rough from the stringer, and drawing it up until such time as it stands at concert pitch. It may be urged that a person who possesses a delicate ear will learn sooner on the first plan, in consequence of the ear not being vitiated by the discordant sounds that are the necessary attendants upon roughing up; but such a person would be quite at a loss when he had to tune an instrument half a note, or even two half-notes (which is not uncommon) below concert pitch. From his comparatively bungling manner of proceeding, he would be three times as long over his work as one that has learned by roughing-up. In short, it is like learning to write elegantly before pot-hooks and hangers are acquired.

All this arises principally from not knowing the part in which the strain of the strings causes the pitch to fall, and to make the necessary allowance for it by drawing up that part above pitch. If the bearings are comprised within the septave F—E, the pitch is found to fall from the included B, all the way up the treble. This is remedied by drawing that part up considerably above the pitch

you are working upon, and, by the time you have finished the treble, it will have settled pretty well down to the perfect octave. Again, the first-named would probably make his pitch exact at starting, instead of allowing for the falling of it afterwards. Of course, I only speak of an instrument that is very flat.

In horizontal grand and square piano-fortes, this strain is very considerable; in cabinets not so great. The reason of this is, that in the latter the strain is in a perfectly vertical direction, and, consequently, they stand longer in tune; but in the two former it is all diagonal—and, indeed, it has been jocularly said, that the square piano-forte is so called, because there is nothing square about it!

The task of roughing-up is materially facilitated by stretching the strings with a well-known instrument called a rubber, made of wood, and, in most instances, covered with leather; this is pressed downwards with considerable force upon the whole length of string. It also has the advantage, where a string is false, *i. e.* not perfectly round, of causing it to become more pure in its tone. Until of late years, piano-forte makers were sadly bothered for wire. The best that could be procured then was the Berlin, or German wire, as it was generally called. But bad was that best; it was only *iron* wire, and neither round, square, oval, nor any other shape. It was very scarce, and difficult to procure in time of war; when Napoleon shut the foreign ports against us, to wit, it was a favour to get it at all at 10*s.* 6*d.* or 12*s.* per lb., and there has been the unexampled price paid for it of 25*s.* per lb. at a public sale. It was also very wasteful; ring after ring having to be thrown aside in consequence of brittleness.

The proud boast was reserved for an Englishman* of overcoming these difficulties, and furnishing *steel* wire as near to perfection† as any thing in this sublunary world. There had been countless trials and experiments made to give to steel such a temper as would fit it for music-wire; but the patience of the English piano-forte makers had been nearly exhausted by their repeated disappointments, and it was some time before it came into general use. Now, not only is nothing else used in England, but at Paris, Vienna, Hamburgh, and even Berlin itself, the German wire has been completely beaten out of the market. This created a new era in piano-forte making; for I think I may safely assert, that piano-fortes have been considerably more improved within the last ten or twelve years than during the previous thirty or forty. Independent of this, it has grown up more into a distinct trade *per se;* formerly their shops were supplied with artisans from the joiners and cabinet-makers—now they are supplied with men regularly brought up to the business from their childhood.

CORIO.

April 20, 1836.

* Mr. Webster, of Penns, near Birmingham.

† He professes to send it out *quite perfect*, and will exchange any quantity from a quarter of an ounce to a quarter of a ton.

CIRCULATING DECIMALS.

Sir,—The following is the rule for mixed circulates, alluded to p. 41, but which, you will perceive, is equally applicable to pure circulates.

Rule.—Divide unity, with cyphers *ad libitum*, by the given number.

Substitute the remainder for a new divisor, and the former divisor for a new dividend.

Proceed thus for six or seven terms, more or less;* then by the rule for continued fractions.

Substitute a fraction, having the first quotient for the numerator, and unity for the denominator, for the first term, and call the fraction A.

Multiply the numerator of A by the second quotient, to which add the denominator of A (or unity) for the numerator of a new fraction, which call B.

Multiply the denominator of A by the second quotient for the denominator of B.

Multiply the numerator of B by the third quotient, to which add the numerator of A, for the numerator of a new fraction called C.

Multiply the denominator of B by the third quotient, to which add the denominator of A, for the denominator of C.

Proceed thus through all the quotients,

* It must rest with the operator to discover when he has calculated a sufficient number of terms to obtain the result; but generally it will be when the remainder is *very considerably less* than the divisor that produces it.

and invert the last result for the required fraction.

Taking the given number ·3488372 + as before, by continual division we obtain the quotients 2, 1, 6, 1, 1, and by the second part of the rule :—

$$\underset{A}{\frac{2}{1}},\ \underset{B}{\frac{3}{1}},\ \underset{C}{\frac{20}{7}},\ \underset{D}{\frac{23}{8}},\ \underset{E}{\frac{43}{15}}.\quad \text{Inverted} = \frac{15}{43}.$$

The rule will, perhaps, be more intelligible by being thrown into the shape of the following formula :—

Let the given number be represented by A.

$$\begin{array}{llr}
\text{Then A)} & 1\ (a & a=2 \\
 & \overline{r'})\ \text{A}\ (b & b=1 \\
 & \quad \overline{r''})\ r'\ (c & c=6 \\
 & \qquad \overline{r'''})\ r''\ (d & d=1 \\
 & \qquad\quad \overline{\&c.} & e=1
\end{array}$$

In this r'—r''—r''', &c. represent the remainders continually substituted for new divisors.

Let the fractions be now represented by $\frac{a}{1}, \frac{m}{n}, \frac{o}{p}, \frac{q}{r}, \frac{x}{y}, \frac{z}{s}$, &c., and the required fraction by Z.

$$\frac{a}{1} = \frac{a}{1}\ \frac{(a \times b) + 1}{1 \times b} = \frac{ab+1}{1 \times b} = \frac{m}{n}$$

$$\frac{mc+a}{nc+1} = \frac{o}{p}\ \frac{od+m}{pd+n} = \frac{q}{r}\ \frac{qe+o}{re+p} = \frac{x}{y}$$

$$\frac{xf+q}{yf+r} = \frac{2}{s}\ \frac{zg+x}{sg+y} = \text{Z}.$$

$$\frac{a}{1} = \frac{2}{1}\quad \frac{m}{n} = \frac{\overline{2 \times 1} + 1}{1 \times 1} = \frac{3}{1}\quad \frac{o}{p} =$$

$$\frac{\overline{3 \times 6} + 2}{\overline{1 \times 6} + 1} = \frac{20}{7}\ \frac{q}{r} = \frac{\overline{20 \times 1} + 3}{\overline{7 \times 1} + 1} = \frac{23}{8}$$

$$\frac{x}{y} = \frac{\overline{23 \times 1} + 20}{8 \times 1 + 7} = \frac{43}{15}\ \text{Z. Inverted} =$$

$\frac{15}{43}$. Fraction required.

Having thus shown the applicability of the rule to pure circulates, I will now apply it to the mixed circulate ·3586956 +.

By continual division, as before, we obtain the quotients, 2, 1, 3, 1, 2, 1, 1; and the fractions. $\frac{2}{1}, \frac{3}{1}, \frac{11}{4}, \frac{14}{5}, \frac{39}{14}, \frac{53}{19}, \frac{92}{33} =$ Inverted $= \frac{33}{92}$, the equivalent vulgar fraction; and the equivalent decimal is, ·3$\dot{5}$8695652173913043478260̇.

Were it possible to ascertain at first that the given number is part of a pure circulate, the rule given by Mr. Peacock is much shorter, and more convenient; but, as there are no means of determining it to be pure until the *whole* of the series is ascertained, it will be necessary to treat it as mixed, and use the foregoing rule. There may possibly be other methods of determining this question; and if so, I should be glad to see your valuable Magazine the medium of communication on this interesting subject, agreeing as I do with Mr. Peacock, that if the attentions of a few minds were directed to it, it would lead to most important results.

I remain, Sir, your obedient servant,

G. C. L.

Kentish Town, April 24, 1836.

P. S.—If the rule be not perfectly intelligible, I shall be very happy to give the process in full, or any required explanation.

ACOUSTICS APPLIED TO THE HOUSES OF PARLIAMENT.

(Extracts from the Evidence of Dr. Reid before the Select Committee on the Ventilation of the Houses of Parliament.)

Have you directed your attention to the communication of sound in public buildings?—Accidental circumstances have led me to pay considerable attention to that subject, of late.

You constructed on some scientific principles the room in which the great dinner was given to Earl Grey in Edinburgh?—I was on the committee on that subject, and many of the members of the committee, along with the architect, were frequently in my class-room; but I cannot take the credit of having constructed it. I believe I gave what hints I could with respect to the form and several other circumstances connected with the sound; but the merit of the arrangements is due to the architect, Mr. Hamilton.

You were aware of all the principles on which it was constructed?—Yes; but I differed with respect to the use of the canvass; I was anxious to increase its power in communicating sound at the expense of some ornament which could not be introduced well without the canvass, though even with the

canvass I believe there was no room in which communication of sound was heard with greater advantage under the circumstances. Perhaps I may be allowed to mention that I tried the room with the canvass, and after the canvass had been taken down, and that, in order to be capable of forming a most decided opinion on the subject from actual trial, I employed people to read and to sing in it, that I might study its power of communicating sound in every possible manner; and thinking it a most excellent opportunity of also trying the comparative power of the canvass and the wood, though I believe people are generally agreed on that subject, I consulted Hertz, the piano-forte player, and also Mr. Murray and Mr. Findlay Dunn, celebrated for their professional talents and attainments in those experiments, and Hertz mentioned particularly, "that the sound was not sonorous," that was his expression. It was beautifully distinct and clear; I am not aware that in any room music was ever heard which was so beautifully clear and so melodious; but at the same time it had not that strength and power which was observed when the canvass was pulled down, and when the sound was strengthened by a reflection from the roof. The beauty of music upon a lake or other still-water is proverbial, and I attribute it to the same cause, to the purity of the tone where there are no prolonged reverberations interrupting each succeeding note.

What should you consider the essential conditions of a room for the purpose of the Houses of Parliament in reference to the communication of sound?—With respect to the form, a square form on the whole I should be inclined to prefer, as bringing the Members nearer to one another than can be done in any other way.

Than by a circle?—I was going to add, than by the circular form, which is very ill adapted for the communication of sound in a building such as the House of Commons, whereas the other is not.

Do you mean perfectly square, or oblong?—I would say about square. Again, the walls ought to be as low as possible, and arranged in such a manner that no sound can be reflected repeatedly from the one to the other. The roof ought to be as low as possible, or as low as may be consistent with the size of the building, and to have a great reflecting power, so that the direct voice of the speaker may be strengthened by the reflection from the roof; and, lastly, the voice having been strengthened by this single reflection, all further continuance of the sound ought to be destroyed by throwing it upon some absorbing surface, as upon an irregularly and matted floor. I might add here, from a number of different experiments, I found no difficulty in conversing at the distance of from 100 to 1,000 feet in the open air. Sir John Ross told me lately, when I met him at Dublin, that he had no difficulty in conversing at the distance of a mile in the still and silent atmosphere, which often occurs in the polar region. Lieutenant Bowen has conversed at the distance of a mile, or upwards, across a frozen lake, and Mr. Parkin, of the Royal Marine Hospital, Woolwich, informed me, among many other interesting circumstances, that at a particular place near the top of the hill at Cawsand Bay, he had frequently heard with the utmost distinctness the laugh and conversation of the sailors on board of the frigates and other vessels at anchor there, one to two miles distant from the place where he was. The difficulty of the communication of sound in public buildings, therefore, must be attributed, in most cases at least, not so much to a want of power in the voice of the speaker as to the interruptions which arise from prolonged reverberation and other causes. In some rooms, after ceasing to speak, I have found the sound continued for five seconds, and I have no doubt that it was continued for a much longer time, though we could not directly affirm that we heard a distinct tone. Every instant that sound is continued, after once a new sound shall have fallen upon the ear, tends to make it less and less distinct.

As to the distance at which it is stated sound is heard in high latitudes, do you attribute that principally to the perfect silence of the atmosphere, a total want of all agitations, or a peculiar state of atmosphere itself?—I should be inclined, from what I have heard myself, and trying the communications of sound in all situations, to attribute it principally, if not entirely, to the extreme stillness of the atmosphere. When the wind flows gently in any particular direction, it favours the communication of sound considerably in the same path. I know an instance where the sound of a powerful military band was heard, though imperfectly, at the distance of twenty miles. The noise of a steam-boat, or even of oars of a small boat, are easily heard, under favourable circumstances, at a distance of many miles.

Your general principle is, in reference to the House of Commons, that there should be one reflecting surface extending as nearly as possible over the Members by the ceiling, that the walls should be non-reflecting, and the floor absorbing, to prevent the echo; but you do not state the form of the ceiling, whether it is to be coved or flat?—The form of the ceiling is that which you see represented in the sketch of my class-room; it should be inclined and meet in a point.

Do you recommend that form of ceiling with reference to its superiority for ventila-

tion or hearing?—On account of both these; I think it frequently happens that both circumstances combine; the same form of ceiling that allows all the moist heated air in a crowded evening to collect at the top, will also throw most broadly the pulses of sound across the greater portion of the audience, the object being, not that the sound should accumulate in any particular part, but be diffused as equally as possible over the whole of the House. If you have a broad reflecting surface, inclined in that manner, it may be shown that that surface is most conducive, and will be most powerful, in distributing the pulses of sound equally among the Members.

But in that form the person speaking from near the wall would be better heard than if he were speaking in the centre?—That may be; but it seems that in every part of a room constructed on that principle, whether the person speaking be in sight or out of sight, whether one or two be in the room, or several hundreds, there is no difficulty either in hearing or in distinctness of articulation. Many rooms will produce a more loud and sounding noise, perhaps they will be better for the *premier coup d'orchestre* in a concert room, but if it is distinctness of articulation that is wanted, or to experience melody in its purest form, strengthened however by a certain reflection from the roof, that is the form I would recommend. The difference between distinctness and purity of intonation, however low the tone may be, and that confused and noisy sound that is produced in some rooms, has been very little attended to, practically, in the construction of buildings, and still less the effect of reflection upon the voice of the person speaking. Where, from any particular cause, many reflected sounds strike upon his mouth, it is impossible for him to articulate distinctly, however articulate, under other circumstances, his enunciation may be; a physical cause opposes the free action of the muscles that regulate those movements by which speech is produced, and any one who studies the subject practically, till experience makes him familiar with it, will acknowledge the great difference in the sensation produced upon the mouth when he speaks in a well-constructed room and then in the focus of a large parabolic reflector, for example, opposed to a powerfully reflecting wall.

Of what material would you propose to construct an interior?—I would propose that it should be constructed of wood, and that it should, as far as possible, resemble the sounding-board of a piano-forte. In experiments in the open air, when we were in a valley, and the situation peculiar, I have repeatedly spoken to individuals 200 feet distance from me when they did not hear a word, if they were in the line of the valley, so that there was a great hollow extending indefinitely behind them; while others who were still more distant than them, at twice or three times the distance, but who happened to be at one of the sides, heard distinctly every word without the slightest effort.

Then they heard reflected sound?—They heard the primary united with the reflected sound; they were so close to the reflecting surface, the primary sound no sooner came to them than the reflecting sound came up and strengthened the primary impression; so in the same manner the roof should be so near the Members that the voice of the person speaking should be strengthened by the reflection. If we admit a certain height for ornament and ventilation, let that be as low as possible, and the more equal will be the communication of sound in my opinion, not only from theory, but from direct experiment in my own class-room and other buildings.

It seems to follow, from what you have said, that you would recommend the Houses of Parliament to be without galleries?—I should strongly recommend they should be without a projecting gallery; but a retreating gallery would not be very disadvantageous.

With reference to the position of the Speaker of the House of Commons, would you propose to adapt what is called the Speaker's chair to the favourable transmission of sound, or trust entirely to the room itself?—I should have no hesitation in saying I would trust entirely to the room itself, were it constructed on these principles. At the same time, if it was fixed that the Speaker's chair should have a place near the wall, which I presume may very probably be the case, it would be almost unnecessary to do any thing for the communication of the sound, as, if that were made a good reflecting surface, and inclined in such a manner that no reflection were kept up between wall and wall, he would require no peculiar arrangement either to hear or to be heard, without any effort, in any part of the room.

In that case the Speaker would always be directing his voice, in point of fact, towards an absorbing surface, for the strangers' gallery must be opposite to him, and not in the side of the roof?—He would, under those circumstances; but at the same time the sound would be reflected from the roof, spreading from the situation in which he was placed on either side the roof, inclining on either side of the Speaker.

Would you explain upon what principle you have a preference for a square to a circular form?—On this principle: whenever there are any concave surfaces, it is the same, generally speaking, with sound as with light; that is, from the angle which the sound

makes as it falls upon the surface, it is necessarily collected into foci, and in circular rooms there are, accordingly, more or less points where the sound is heard with greater power, while it is comparatively deficient in other places. The object in the House of Commons being an equal transmission of sound, that is the reason why I give a preference to a flat surface.

If you were understood rightly, you would depend principally on the ceiling for the reflection of the sound, and you propose to have walls of an absorbing surface?—The part of the walls that are brought more immediately into play would be so extremely low, and converted at the same time into a kind of gallery, that perhaps, with the exception of that part where the Speaker may be placed, they could scarcely be said to have any of the properties of ordinary walls in reflecting sound.

By adopting the circular form, you would bring the Members closer together, and therefore in that point of view they will be able to make each other heard more easily?—I am not aware that the advantage gained in this respect would in any way balance the difficulties that would present themselves from the collection of sound in foci; and even, whatever materials are used, it is perhaps impossible to have a surface that is absolutely non-reflecting; it is more or less reflecting merely in comparison, for even the very canvas we at times put up to destroy the reflecting power which may predominate in some particular buildings, has been known in other cases, when stretched, as in the sails of a ship, to collect pulses of sound from bells that have been ringing 100 miles distant, and rendering them observable.

As to the position of the seats, have you any idea whether it is convenient or no for the transmission of the sound that they should be raised one above another?—As the floor is considered to be an absorbing surface, on the principles I have alluded to, I should imagine that if they were elevated one above another, so as to allow the Speaker to see the Members distinctly, and the Members to see one another, it would rather facilitate the communication of sound, and the perfect absorption of the reflected sound.

In fact, the elevation of the back seats would tend to diminish practically, so far as sound went, the height of the walls?—Yes.

And to diminish the inconvenience of the circular form?—Yes; at the same time it being admitted that the power of sound is proportional to the intensity of the mechanical impulse made, the area through which is to diffuse itself, and the manner in which it is strengthened by the reflection from the walls, every space, every superfluous space, that can be cut off without interfering with the principles above alluded to, or rather with their applications, will be a gain to the Members in facilitating the communication of sound.

As to the openings in the roof and walls for light and air, should you propose to arrange them according to any past experience you have had?—I should consider that an object of very great importance. The first thing that led me to direct my attention to this subject was what occurred in a church, where it was almost impossible to hear the preacher, in consequence of the prolonged reverberation. After spending some little time in it I left it, and was surprised, when I was totally out of sight of the preacher, to find that I heard every word distinctly. On examining into the circumstance, I could only attribute it to this cause, viz. that the direct voice of the speaker was perfectly sufficient to be audible in every part of the building, but that, at those particular openings into the passage, it alone had come out, and there affected my ear alone, whereas, in the interior of the building, I not only heard the direct voice of the speaker, but also the confused noise produced by all the prolonged reverberation of preceding words. If, then, from one or two apertures alone such a body of sound can escape as will render the speaker's voice distinctly audible in separate apartments, we are entitled to infer, that if that portion be prevented from escaping, it would tend much to add to the power of the speaker's voice within the House. Further, not only will the loss of sound be prevented, but also the entrance of all discordant sounds from without. In every large city there is a continual hum, and the noise of people walking in the street, of bells, of horses, of coaches, and the like, though on every occasion they may not be distinctly audible, still produce a certain amount of sound, which detracts from the purity of intonation. If, then, the loss be prevented on the one hand, and the entrance of discordant sounds on the other, there will be much added to the power of the room in communicating sound. In those rooms where I have seen all those openings arranged in such a manner, that while air was permitted freely to enter or to escape, yet the sound had to be reflected two or three times in passages, so that it was lost as it were, and could not produce any specific effect if entering from without, or reflected back into the room if formed within, the intonation was more powerful and more distinct than when that was not attended to.

Is the glass of windows equally efficacious, in your view, of sound as wood?—Yes.

Would you state to the Committee whether you consider glass as eligible for the reflection of sound as wood?—I should certainly consider it so in those situations.

As to the outward walls, what sort of thickness do you think they should be with regard to the sound; ought there to be a very thick outer wall or not?—I should prefer a thick outer wall, as giving more power to heating in winter and of cooling in summer, as well as in reference to the communication of sound.

And in excluding sound?—Yes; a thick wall would render it freer from all disturbing causes, whether from sound or cold.

Do you contemplate the actual roof of the House of Commons should also be the outer roof, or a double roof?—I should contemplate a double roof; for in case of noise from rain or hail, if there were only one roof, it would be almost impossible to prevent the greatest interruption, and in summer no means could be adopted with facility to prevent the room becoming extremely warm.

Would you rigidly interdict the use of all ornamental work in such a roof?—On no account; I should consider it not merely desirable for its own sake, but advantageous for sound. Had it not been necessary to attend in the strictest manner to economy in a large establishment I put up at my own expense alone, I should have had every one of these cross partitions in the roof ornamented. I consider these cross partitions are of great value in respect to the communication of sound, and on this ground: in the first place, experimentally, I found that if I made an impulse in water in a particular direction, instead of that impulse extending, as it were, throughout the whole of the water, as it is generally believed to do, a wave was made to roll along upon a particular surface, while the rest of the water was quiet and still; this I believe to take place to a certain extent in the communication of sound; if the voice, for instance be directed on an extremely plain surface, at a particular angle we know we can speak to people at a great distance, if we both go nearer the side of a wall; now if so much of the sound were to fall on the roof at this particular angle, my opinion is, it would run along the roof a considerable way before any amount of it would be reflected on the ground; whereas if the surface of the roof be broken by transverse beams (by pillars or pilasters, if it be a wall), the sound will not travel in this manner; there is always a reflection at each part to the ground below. There is a tunnel connected with one of the railroads in the west of Scotland, in which, as I was informed by Mr. Granger, an engineer, it was utterly impossible for one person to hear another at any distance. It happened, however, that either some pilasters were put along the walls, or the tunnel was made irregular, whereas formerly it had been made smooth, and after that individuals heard each other in any direction, at any distance, with great facility and very distinctly.

You do not suppose this interruption would, in fact, impede the voice from going to the extremity of the room from where the person speaking was?—To a certain extent it would necessarily affect the progress of the sound; but still, if the general outline is alluded to, I believe the diffusion on the whole would be more equal than what it would be without them.

Could it be admitted upon principle, could you beforehand state what amount of ornaments could be safely introduced, or what amount ought not to be introduced, so as to guide the architect in his course?—So much would depend on the particular construction of the building, that I do not see at once that I could answer that, unless the question was subdivided. But this I might say, that I have seen buildings which were entirely covered with ornaments, and that in these buildings the sound of the voice was heard distinctly, and I would only refer to principle, but let applications be made according to the peculiar kind of building to be adopted for the House of Commons; so long as you can bring up a reflecting power to act upon the air, while the direct voice of the speaker is still sounding there, so long you will strengthen the voice of the speaker; but I found every thing upon this, that the human voice of itself, when it does not meet with interruption, is sufficient to fill the most ample assembly that ever has been made, provided there be no noise from extraneous sources; that you may, if you choose, dispense entirely with the additional power of reflection, and have the walls crowded with ornaments, but taking care there is a perfect power of absorption, so that the audience hear solely by the direct voice of the speaker, and in ninety-nine cases out of one hundred, if the room be moderately quiet, they will hear distinctly; but they will not hear that body of voice which they would have heard had they also gained by the reflection from the roof; and in a building such as the House of Commons, I consider it would not be desirable to take away this reflected strength which may be communicated to the voice; performers on instruments and singers say, when they are in a room which has no reflecting power, that the sound escapes easily enough, but that they do not experience that resilient and sustaining power which makes so many rooms so delightful to speak or sing in; these who pay much attention to the subject feel the tone escaping easily from the mouth, but they do not feel the sound sustained and buoyed up, as it were, where there is too little reflection; in other rooms, where the reverberating power is so great that it

interferes with speaking, they are precisely in the reverse condition; when they sound a particular note, they feel there is something playing and working on the mouth, a mechanical power preventing the emission of the tone they wish to introduce; in some rooms, many of which I have been in, if any one stand in a particular position, the voice is returned to the focus if they are placed in it, and they feel as if some one were actually knocking them on the mouth. In one of the reflectors they use in a chapel, which I had been invited to examine, a preacher went up one day who had accidentally not been informed of its peculiarities; there was not only a focus for the emission; but also for the reception of sound, and when he had said two or three words he suddenly turned round, believing some one was mocking him, but it was only the reflected sound of his own voice, which sounded loudly to him, but inaudible to any other person. In the adaptation of these parabolic reflectors, any part of the audience excluded from its influence hear as ill as the others hear well.

You would not think it advisable to place the Speaker within a chair with a parabolic sounding-board?—I should think it unnecessary with that construction of building; and it would, to a certain extent, be liable to the objections mentioned.

Would it or would it not be desirable to maintain, as nearly as possible, a unity of atmosphere in the room, with reference to sound, quite apart from ventilation?—I consider that one of the primary objects of attention, but to what extent that does actually interfere with sound, I am at a loss to say; it is admitted on all hands, and it is known that in an apartment, even a small apartment, we often have different strata of air, and the sound in passing from one to another is much affected in the same manner as light; thus, when we look at any object on the wall through a current of warm air, as when the sun is shining on any building, a current of warm air from a chimney being interposed between us and it, we see the tremulous motion of the air indicated by the unequal reflection of the light upon the wall; so in the same manner, I believe, that when sound passes through different strata of air, a similar disturbance induced, but preventing it from being so clear and uniform as is desirable.

Would you positively interdict the use of drapery, particularly round about the windows or the cornices?—I should not consider it necessary to interdict the use of drapery; but whenever there was a powerful reflecting surface, and it was required to take advantage of that surface, then the drapery ought not to be used.

You would not interdict drapery on the side walls, but you would from the windows above?—From the roof, or from whatever part we wish a reflecting power.

As to the smaller rooms connected with the House of Commons, you would scarcely propose to alter the ordinary ceiling, perhaps?—It would not be so necessary as in the larger apartment for the meeting of the House; but the same remarks, it must be remembered, apply to both. There is a great harshness and indistinctness often communicated to the voice, even in small rooms, and it is remarkable how sensitive some people are to the manner in which sound affects them. I have been in some rooms, where it was impossible to converse even with a moderate party, unless with a considerable effort from the power of reverberation. I have been in rooms where there were alcoves at one end, and whenever any individual happened to sing in a particular position it made a great difference in the voice, and on trying it experimentally, a number of persons going to a distance and shutting their eyes, while one individual, trying the experiment, walked across the room, while speaking. I have seen the others raise their hands whenever he came to a particular part, indicating the change which they all perceived. The power of the voice may perhaps be such as not to make it a matter of great consequence in these small rooms; but yet there is a very great difference in the unity and pleasantness in the tone of voice in different rooms, according to the form. I may state with reference to the same subject, there is a room not larger than some of the Committee-rooms may be, in which it was found almost impossible to carry on a school from the amount of reverberation, and when any individual sounded any note in a prolonged voice, it was quite like the sound of a trumpet, it was continued so long after he had ceased; that room was about forty-eight feet long, twenty or thirty broad, and sixteen high. The roof was arched, but the curve was not great. It was improved very much by suspending curtains and drapery from the cornice.

THE BRITISH MUSEUM AND THE PROVINCIAL INSTITUTIONS.

Sir,—I am sorry to be obliged to appear pertinacious in opposition to so very polite an antagonist as your correspondent, S. S.; but, to say the truth, it appears to me that, by the list of literary Institutions he has furnished to your last Number, he has completely established my case instead of his own. If the Aberbrothick Subscription Library, the Bur-

Subscription Library, and all the bead-roll of Subscription Libraries, be considered "public and perma- iterary Institutions, and as such en- to receive duplicates from the British im," I would advise Mr. Bull, of -street, Mr. Horne, of Cheapside, ll the other proprietors of circulat- braries about town, to bring *their* under the notice of Parliament ut further delay. It would, I feel excite about as much surprise in brarian to one of these local and e establishments for a stranger to nto their rooms and set about avail- mself of his right to examine the ds, as it would, in one of these n caterers to the public, for a per- take up a novel from his counter ropose reading it through—free, for nothing. It seems, indeed, S. S.'s statement, that the condition ich the Records were presented was, ey should be accessible to any per- ithout difficulty; but I, for one, l not like to be the unfortunate compelled to bring this circum- to the recollection of the librarians. establishment of the kind which I nt (the London Institution, in ields) there is a complete set of the issioners' Records presented by but though on the back of the title- of each volume there is a printed , that in the event of the dissolution Association, the books are to be ed to the Secretary of State for the Department—which shows that tablishment is not looked upon as arily "permanent"—I have never ed any thing to intimate that the on has the effect of rendering the a whit more "public" than it was —that is, not at all. Such is the ce of the case, at all events, if not eory; and if it were not, I suspect mmissioners would have had a few n-loads of their ponderous publica- eturned on their hands. But even grant that this right of inspecting ecord donations were in full exer- ow can this circumstance be said ler the Institution generally "pub- ny more than an occasional per- n for a stranger to inspect the *Court* or *London Directory* at the circu- libraries aforesaid, would confer m a right to a term now proposed e such privileges attached to it? So much for the publicity; as to the per- manency of such establishments, surely none need bid fairer to bloom and flou- rish than the Surrey Institution in the Rotunda, near Blackfriars' Bridge, some years ago; and yet has it not long given way to the Rev. Robert Taylor, the wax- work, the wild beasts, and one knows not what else? Besides, the list given by S. S. is not that primarily selected by the Record Commission for the reception of its favours. In a return to an order of the House of Commons in February, 1822, there is a "List of Public Libra- ries and Repositories to which the Distri- bution of Works printed under the Record Commission is *limited*," or just then *was* limited, in which not more than two or three of those mentioned by S. S. are in- cluded. This list, of course, takes the precedence when any privilege is in ques- tion; and I hope, for the honour of S. S.'s consistency, to find him in some future letter advocating the propriety of bestowing duplicates on the Library of Doctors' Commons, on the King's Re- membrancer's Office in the Exchequer, on the Auditors of the Land Revenue, and the Town Clerk's Office, city of Lon- don—or, to quit the metropolis, on the Episcopal Library of Worcester at Har- tlebury, and a number of other dead- alive "repositories" of the same kind, which, of course, since thus patronised, must be public and permanent.

The only proposal which can, I think, be seriously supported for the disposal of the Museum duplicates, would be to pre- sent them to the Trinity College Library of Dublin (which, in that case, ought to be rendered more accessible)—and if that were in possession of them, to the Advo- cates' Library at Edinburgh, which is said to be accessible enough—and so on to the Bodleian at Oxford, and the Pub- lic Library at Cambridge. All these li- braries ought, in return, to be bound to offer their duplicates to the rest in the same succession, beginning with the Mu- seum; and any work that was found to exist in them all, might be put up for sale without any compunctious visitings of conscience. Perhaps, however, it might be advisable to place second in the list a large public library, to be founded in London, to consist entirely of dupli- cates of works in the Museum, and to be open to every one without any recom- mendation or introduction whatever. It

is obvious, that while the Museum is conducted on its present liberal plan, while every visitor to its reading-room is allowed the most unrestricted use of its most valuable treasures—of unique Caxtons or of unique manuscripts—in a manner which, as far as I can gather, is both unexampled and unimitated in even the most liberally-conducted libraries of the Continent; it is obvious, that while this takes place, there must be some guarantee of the character of the visitors required, and indiscriminate admission of the public is out of the question—and yet indiscriminate admission is certainly one of the chief advantages that every public library ought, if possible, to afford the public. A question arises, perhaps, in a company, as to the date of some past event, or the dimensions of some building, which can easily be settled by reference to an old volume of the *Gentleman's Magazine*, or an article in *Chambers's Cyclopædia;* but without one of the parties happens to have access to the Museum, or some literary Institution which possesses the works that are wanted, there is no way of coming at the fact. Yet the chief use of a public library must surely be to afford to *all* the inhabitants of the city that contains it, the means of ascertaining any thing like this that may chance to be either useful or interesting. Under the present system, however, there is no opportunity for any person to take a glance at the commonest work in the Museum, who is not, at the same time, entitled to have out for inspection volumes more than worth their weight in gold. There are two methods of remedying this deficiency. The present reading-room may be retained under its present system of management, and an additional one provided in another part of the Museum open to all comers, who may be at liberty to call for any work included in a select catalogue, comprising all works of general use and reference, but none of great value and rarity, and none of the manuscripts. A catalogue thus formed would contain, perhaps, about 150,000 of the 220,000 volumes of the Museum, which would thus become a source of general instruction to the whole metropolis. This plan, however, which, as far as I am aware, is entirely new, might perhaps in its operation be found invidious. The only other way, then, of having a thoroughly public library would be to found a new one, and this should, I think, entirely consist of duplicates of the British Museum. Indeed, it appears to me, that when there are more national libraries than one, the smaller ones ought all to consist merely of second copies of part of the great central establishment. Every thing unique that the Government or nation possesses ought, in reason, to be deposited in the great Institution; and of every thing that is not unique, at least one copy. Yet this very simple plan appears to have been entirely overlooked at Paris, where they boast of having nine public libraries, and works are often wanting at the principal one which may be found in the others. The student has thus to make inquiries at nine different libraries (we cannot say to search the catalogues, as in such cases there are no catalogues to search, a circumstance which the wholesale admirers of Parisian Institutions should remember,) before he can be certain whether a book he wants is or is not out of his reach, and may perhaps find the grammar of a language in one library and the dictionary in a second.

Talking of catalogues, however, I must avail myself of S. S.'s obliging invitation, which your silence gives consent to, to make a few suggestions on the subject of that of the British Museum. One of the great wants of that establishment appears to me to be not only a classed catalogue of the books that are there, but of the books that ought to be there. At present there is not the slightest doubt that many of the departments in that library are miserably ill-filled, and it will rather redound to the disgrace of the institution if the catalogue be printed without any method being taken to supply the wants. Were a list made of what these deficiencies are, a great number of the gaps might be filled up. For instance, the department of Danish literature has been almost entirely neglected. Holberg, as every body knows, is the Moliere of Denmark. By a singular infelicity, while there is almost a complete collection of his other works at the Museum, not one of his plays is to be found there. Suhm, the well-known Danish historian, wrote sixteen quartos on the annals of his country, and some short historical novels of great merit. Of these quartos the first two or three are at the Museum, and not the others,—the tales which appear to have produced a sort of "Waverley"

on in Denmark are entirely miss- These authors are of the last cen- the Danes who have written in sent, appear to have been entirely en. Now if, before the catalogue Museum were published, a person nted with the Danish language erature were sent to Copenhagen Royal Library of which, a copy y work in that language is de- , he might make out a complete such works as were worthy of a n the Museum, and might, doubt- once purchase in that capital a f most of the numbers. A similar ould by all means be adopted with to Sweden, Russia, and even , though Prince Czartoryski's li- resent of books in the Polish lan- to the Museum a year or two ago, led up that branch better than hers. To wait for the slow drib- n of books from these countries les in London would be ridiculous iterary intercourse between us and s shamefully feeble—and the only procuring a really good collection r books, is by sending a literary tion to Copenhagen, Stockholm, . Petersburgh. It may be asked r this feebleness of literary inter- is not a proof that the advantages erived from this expedition, would worth the trouble and expense of ay it not rather be urged that this ct, that Danish, Swedish, and Rus- ooks are scarcely to be met with here else in London, is an addi- reason that they should be at the m. I would go further and say, hat really is not worthy of a place here, is worthy of a place there, ght to be found there. Old news- for instance, are mere lumber in te house, yet a large collection of wspapers forms deservedly one of ists of the establishment. To re- the subject of the "literary expe- " it was observed by Sir Henry in his late evidence before the ttee, that many of the books were wanting in the Museum not be bought at once from book- shops, they must be waited for ked up as opportunities occurred. true with regard to some, but I nvinced not with regard to the number. From the great defi- s in foreign literature, and that in the very newest foreign literature, the yearly reports of the Swedish Academy, for instance, on the state of the sciences, which, however hard to procure in London, must, of course, be easy enough to procure on the spot of publication; it is not too much to say, that there must be at least 100,000 volumes on the shelves of booksellers in Europe which deserve a place in the Museum, and might, were money liberally granted, and proper spirit exerted, at once be transferred there. Before any new catalogue is printed, an extraordinary grant of Parliament for this purpose should be applied for, and a great effort made — for, in fact, what reason is there unless the collection in some degree approaches to completeness, for *printing* the catalogue at all? It cannot serve as a sort of index to literature to assist in the formation of other libraries—it cannot form a trophy of the literary honour of the country—it would rather be a monument of disgrace. The mere purpose of informing a visitor to the Museum of what books he will find there, may be as well or better served by manuscript catalogues. The addition of about 100,000 volumes would really place it "in a range with the first libraries of continental Europe," and we might then feel some pride in its condition.

When the departments were once well filled with the standard literature of the past, it would be easy to keep on a level with the current literature of the day. The British Museum should regularly take in at least *one literary journal from every country in Europe*, containing reviews and announcements of new publications. It should be part of the duty of the librarians to peruse that, and to make a note of every work that seemed worthy of admission to the library; these might then be ordered at once from the places of publication, one of the objects of the literary expedition to the north having been, of course, to establish a connexion with one of the chief booksellers of each capital. A constant supply of foreign literature would then be pouring in; and to mention the means of procuring that are so obvious, that it is matter of wonder the Museum should be so defective in this respect as it is. Every publisher is bound by Act of Parliament to send a copy of every book he publishes, *unasked for*, to the Museum;

but, in point of fact, not more than about half of the English publications of late years will be found there, if so many. A few prosecutions of the publishers would soon produce a change in this; and as, however much they complain of the demands of other institutions, authors never complain of that of one copy to the Museum: this course might be adopted without objection, due notice having been previously given in the newspapers of an intention to insist for the future on the full advantages of this valuable privilege.

Still another method would be requisite to ensure a good supply of a third branch of literature—the colonial. Such is the irregular apathy manifested towards this, that I once searched the catalogue of the Museum in vain for the *New South Wales Magazine*, which, though published at Sydney, is regularly transmitted to an agent in London. Of course it was useless to expect to find there the interesting periodical publications which have been lately edited in the English language in India by young Hindoos, who have caught from their foreign rulers the wish to excel in science and literature; and yet what works could be named more worthy of a place in the national establishment of England? An order from the Lords of the Treasury for the careful preservation of files of domestic newspapers to be transmitted to the Museum, was deservedly a theme for the commendation of the press about two years ago. A similar one to some of our numerous colonial officials to preserve and transmit us sets of colonial newspapers, magazines, and reviews, would do more than any thing else to throw a steady light on the history of the colonies —and as the publications, not periodical, are there so few, a copy of them might be ordered to be procured at the Government expense for the same purpose. This, I will venture to say, would, if carefully attended to, form in a few years one of the most valuable and interesting, as well as one of the most truly British parts of the Museum.

One other suggestion, and I have done for the present. It is this:—on the inside of the binding, or on the fly-leaf of every book in the Museum, without exception, should be recorded the date of *the establishments becoming possessed of it; and the mode.* The books presented by Sir Joseph Banks invariably have his name and coat-of-arms pasted in, and this at once reminds every reader to whom he is indebted for the pleasure he is deriving. A sentiment of grateful respect is thus excited, which is a deserved tribute to the public spirit of the donor. But with most of the other books this is not the case; and I almost felt as if I had defrauded some one of his just rights, when, after luxuriating for more than a year on the rich collection of books on Polish subjects added in 1833 to the Museum, I then first discovered that the whole had been presented by the till then unthought of Prince Czartoryski, who, driven from his own country to take refuge in ours, thus generously contributed to the literary glory of both. With donors, the insertion of the name is due from a principle of gratitude, and would be good policy also, as it would most probably induce them not to insist, as they sometimes do, on the embarrassing compliment of keeping their libraries separate in the midst of a larger one. Even in cases where the book was not given, but bought at a sale, it would often be interesting to know to what person it belonged, and the addition of the dates would give an interesting view of the progress of the library. I do not know that this plan has ever been adopted any where, but it might, I think, be adopted with advantage every where.

I could still write on about the Museum

"until my fingers would no longer wag,"

but I must remember that I am writing a letter to a magazine, and not a separate pamphlet, like Mr. Edward Edwards. In the hope, therefore, that these suggestions may find as indulgent judges as my former ones, I take my leave, and remain,

Yours, &c.

P. P. C. R.

May 4, 1836.

ACCOUNT OF THE MANUFACTURE AND TEMPERING OF SWORD-BLADES IN THE PROVINCE OF CUTCH. FROM INFORMATION COMMUNICATED TO CAPT. BAGNOLD, R. M., BY HIS BROTHER, LIEUT.-COLONEL BAGNOLD, LATE PRESIDENT OF THE REGENCY IN CUTCH.

These swords are celebrated throughout India for their peculiar strength and

edge, and are thus made:—An inch bar of fine Swedish or English steel is forged out into plates seven inches long, one inch broad, and one-sixth of an inch thick. Similar bars of fine, soft iron are prepared in the same manner. These are smeared with a paste of borax dissolved in water, and laid in piles of twelve—nine of steel to three of iron, or three to one, alternately: each pile is wrapped round with rag thickly plastered with mud made of a loamy earth; then heated, welded, and drawn out to a bar one inch and one-eighth broad, and one-third of an inch thick: this is bent zig-zag three or four times: is again welded and drawn out to half an inch thick; and, during the heat, borax is frequently dropped on the metal while in the fire. Two of these bars are next welded into one, and, when about twelve or fourteen inches long, it is bent into the form of a loop or staple; in the middle of this a piece of fine-grained file is inserted, of the same width, and nearly as thick: all is then welded together, and the blade is formed.

Tempering.—An earthen pot, twelve inches wide and six deep, is notched on the edges (the notches being opposite each other) with a file, about a quarter of an inch deep, and is then filled nearly up to the notches with water, and oil is then poured on the surface. The blade, being heated equally to a light red, is removed from the fire, and the point, entered into the notch on one edge, is passed to the opposite one, keeping the edge from a quarter to half an inch in the oil: it is drawn backwards and forwards rather slowly till the hissing ceases, and the rest of the blade above the fluid has become black; a jug of water without oil is then poured along the blade from heel to point. In order to take out the warp produced by tempering, the blade, when nearly cold, is passed over the fire three or four times; then being brought to the anvil, is set straight by striking it regularly, but moderately, with a hammer; by this means a Damascus-carved blade may be brought nearly straight. Blades made this way, in my brother's presence, when he was President of the Regency in Cutch, were proved, previous to grinding, by striking at stones, ramrods, musket-barrels, and even wheel-tires, without injury to the edge.—*Trans. Soc. of Arts.*

HUNTER'S STONE-PLANING MACHINE.

At a late meeting of the Institution of Civil Engineers, the merits of the patent stone-planing machine formed the subject of conversation. Drawings of the machine, and several specimens of the planed stone, being laid upon the table, Mr. Lindsay Carnegie explained its mode of operation, and made several statements as to its actual performances. The principal objection to all former machines for a similar purpose—the immense friction and consequent destruction of tools—seems to have been completely obviated in this instance, as Mr. Carnegie stated, that "the wear of tools was so trifling, that it was scarcely worth noticing in calculating the expense of working the machine:" this arose, he said, from the peculiar mode of working,—the tool not coming in contact with the stone more than four times in a foot, and thus not being heated by friction, it does not lose its original tempering.

At a subsequent meeting of the Institution, the subject was resumed, when Mr. Cubitt, the eminent engineer, said he had occasion to be in Scotland a short time since, and having heard much of Mr. Lindsay Carnegie's machine and its operations, he sent three slabs of stone—two slabs of very hard slate stone, and one slab of hard Yorkshire—that he might see them planed in order to speak to its effect. These slabs were each three feet long and fourteen inches wide. They were put upon the planing machine, and the roughing tool passed over each of them in three minutes, and the smoothing tool in four minutes; it planed them very well. His opinion of Mr. Lindsay Carnegie's machine was decidedly favourable. He thought it not particularly useful in dressing stone for building purposes, but more adapted for slates, pavements, and landings, which it planes admirably. He thought all slab work might be planed by it at a farthing, or from that to a halfpenny, per square foot.

The immense saving which will be effected by the use of this machine in London may be imagined from a statement made by a member, that he had just before been charged *ninepence* per foot for smoothing a stone seven feet by four and a half. According to Mr. Cubitt's statement, the maximum cost by the machine would have been *one halfpenny!*

We understand that a working model of the machine has been placed in the Adelaide Gallery for the purpose of exemplifying its mode of working—which it does as well as can be expected, when it is considered that the moving part of the model does not weigh above a hundred weight, while the same part in the machine itself weighs about two tons. From this model, however, in connexion with the description given in our 636th Number, any person interested may fully understand the whole *modus operandi* of this important invention.

NOTES AND NOTICES.

Economy in Linen-Washing.—A correspondent of a Dundee paper writes as follows:—"After many experiments made by myself and others, I find that a little pipe-clay dissolved among the water employed in washing, gives the dirtiest linen the appearance of having been bleached, and cleans it thoroughly with about one-half of the labour, and fully a saving of one-fourth of soap. The method adopted was, to dissolve a little of the pipe-clay among the warm water in the washing tub, or to rub a little of it together with the soap on the articles to be washed. This process was repeated as often as required until the articles to be washed were made thoroughly clean. All who have made the experiment have agreed that the saving in soap and labour are great, and that the clothes are improved in colour equally as if they were bleached. The peculiar advantage of employing this article is, that it gives the hardest water almost the softness of rain-water.

Purification of Coal-gas.—Mr. H. Phillips, superintending engineer of the Exeter Gas works, has discovered the means of arresting the volatile alkali, to which, from its known corrosive property, when in contact with copper or brass, is to be attributed the destruction of cocks, fittings, and meters; and as azote (one of the constituents of ammonia) is highly injurious to respiration, that peculiarly pungent and obnoxious quality of the air in rooms in which gas is burnt for a long portion of the night, is probably augmented, if not produced by it, from the circumstance of the ammonia not being previously separated; azote is alike injurious to combustion:—by employing two burners of the same size, and supplying one with gas from which the ammonia has been removed, and the other with gas from which the ammonia has not been removed the superiority of the light produced by the one over that produced by the other will be clearly apparent. Mr. Phillips has taken out a patent for his discovery.—*Worcester Journal.*

Preserving Paste.—Paste made by putting acetate, or sugar of lead, into it, instead of the old way of mixing it with alum, keeps it from moulding, and quite moist for months together.—*New Monthly Magazine.*

New Lamp.—A lamp of a new construction, which describes a circle of light of about thirty feet in diameter of the apparent intensity of sunshine, showing the objects within its sphere as distinctly as those on the table of a camera obscura, has been erected at the head of the inclined plane in St. Leonard's depôt. Its object is to enable the engine-men to have a distinct view of the inclined ropes during the night, and this has been fully attained. The lamp consists of an argand burner placed in the focus of a large speculum of a peculiar form, by which the whole light is distributed just on the space where it is required; it is computed that the light on the above space is equal to that of twenty-five or thirty similar burners in common lamps. A lamp of this kind we have no doubt would be useful for other purposes; it appears to us that the largest assembly room might be brilliantly lighted by one placed at each end of the room, and one would be sufficient to light the stage of a theatre. The cost of this one is said to be about 200*l.*, but we understand it saves an annual expense of about half that sum. The inventor is a Mr. Rankin, and he names it the Conoidal lamp—probably because the light is thrown from it in the form of a cone.—*Caledonian Mercury.*

New Liquor-Gauge.—A gauge, upon a very simple and excellent principle, which has just been introduced in the new gin palaces, has been invented by Mr. Fage, the hydrometer manufacturer, to show the quantity of liquor, in inches, contained in a cask or vat at any time. The gauge is a vertical glass tube of the same altitude as the cask or vat, and about the size of a large barometer tube, open at both ends. The lower end is securely let into a brass tube about six inches long, at right angles, with a valve, or stop-cock; this tube is fixed into the lower part of the side of the cask, as near the bottom as can be, similar to a cock. The glass tube is attached to a brass index about two inches wide, and of the same height as the glass tube, which is divided into inches; and the number of inches is engraved in figures, reading from the bottom to the top. It is evident, when the valve at the foot of the glass tube is open, the liquor in the vat or cask will rise to the same height in the tube as it is in the vat; and, by means of the brass index, that it will show the number of inches of liquor in depth there are in the vat or cask. It saves considerable labour and trouble to the Excise officers; as, by calculating the quantity there is in each inch in depth in the cask when the gauge is first fixed, they can make their entries without the trouble of the gauging-rule.—*Architectural Mag.*

Communications received from Mr Mackintosh—Mr. Elliott—Iver M'Iver—G P.—A Constant Reader—Mathematicus—W. W. G.—Mr. Barrett.

Erratum.—Page 20, column 2, line 24, *for* "$15\frac{15975}{59049}$," read "$15\frac{15795}{57049}$."

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C. E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

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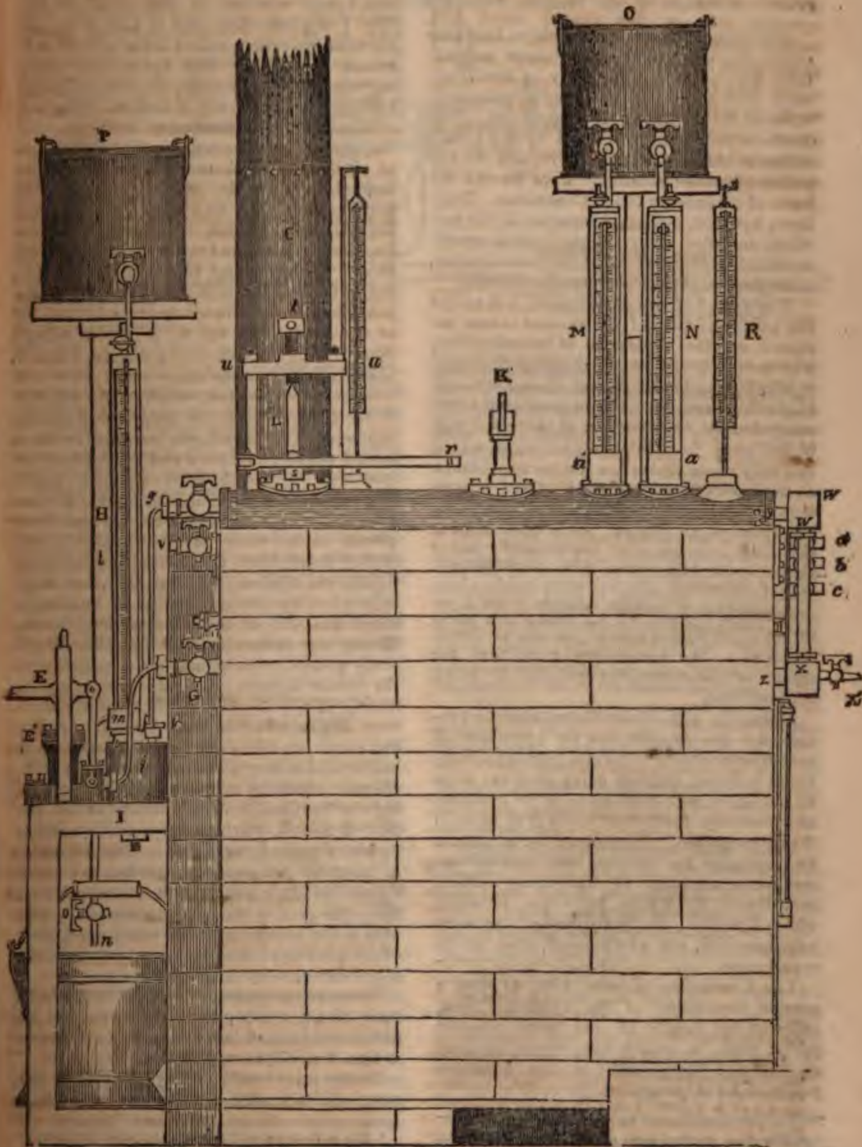
AMERICAN EXPERIMENTS ON STEAM-BOILER EXPLOSIONS.



REPORT OF EXPERIMENTS MADE BY THE COMMITTEE OF THE FRANKLIN INSTITUTE OF PENNSYLVANIA ON THE EXPLOSIONS OF STEAM-BOILERS, AT THE REQUEST OF THE TREASURY DEPARTMENT OF THE UNITED STATES.

(From the *Journal of the Franklin Institute.*)

The Committee of the Franklin Institute on the Explosions of Steam-Boilers, respectfully present to the Secretary of the Treasury, their Report of the experiments undertaken at the request of the department. The queries which were submitted by the Committee to the officer at whose request the experiments were instituted,* have formed the basis of the labours of the Committee. They have, however, availed themselves of the privilege accorded, of trying such other experiments as might grow out of the investigation, or as they might deem of special interest.

The object of the experiments was to test the truth or falsity of the various causes assigned for the explosions of steam-boilers, with a view to the remedies either proposed, or which may be consequent upon the result of the investigation. The causes being accurately known, the attention of ingenious men is led away from false suppositions, which can only waste their time and talent, if taken as the basis of their plans for safety; greater hope is afforded of an efficient remedy; applications of an indirect, or it may be of a positively injurious sort are avoided; and if the causes be found to be such as, for the present, to baffle ingenuity in their removal, the attention is directed more fixedly towards the means of protection against the effects of such accidents. The Committee hope that the results of their inquiries will not be found without fruit.

It was the aim of the Committee to provide for the experiments an apparatus of such dimensions as to furnish results applicable to practice, without being so great as to be managed with difficulty, or to increase, unnecessarily, the danger incident to parts of the investigation. To arrange the apparatus and complete the details, they secured the services of an able and experienced mechanic, David H. Mason, by whom, or under whose direction, the nicer parts of the work were executed, and who assisted, also, in the experiments.

The Committee propose, first, to give a general description of the apparatus used, followed by details in the more complex parts; next, to report the results of their examination upon each of the questions proposed for investigation.

* The Hon. S. D. Ingham, late Secretary of the Treasury of the United States.

General Description of the Apparatus.

The boiler used by the Committee, and represented in figs. 1, 2, and 3,* was twelve inches in interior diameter, two feet ten and a quarter inches in length within, and one-fourth of an inch thick; of rolled iron, with the heads rivetted in the usual manner. Fig. 1 is a side-view, and 2 and 3 are end-views of the boiler, and of the apparatus connected therewith. The boiler was placed horizontally in a furnace, the fire surface extending about half way round the cylinder.

The furnace was arranged for a charcoal fire, the grate-bars extending the whole length of the boiler, and the fire being applied through nearly the whole length. The draught entered by an opening, closed in the usual manner, and left the furnace through a flue placed at one end and side of the boiler. It will be convenient to use the terms fire-end or front of the boiler, in reference to the proximity to the furnace-door, and back-end of the boiler. In fig. 2, A is the ash-pit door, B the furnace-door; and in 1 and 3, C is the furnace-chimney.

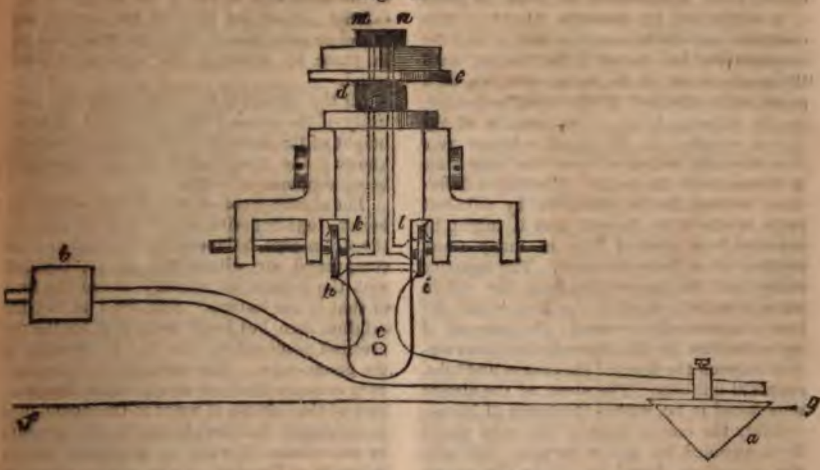
In order to examine, readily, the interior of the boiler during the progress of the experiments, each head was provided with a glass window (D, figs. 2 and 3). The glass used was three-eighths of an inch thick. The openings in the ends, which were rectangular, were two and a half by one and three quarter inches wide. At first a glass plate, rather larger than the rectangle just mentioned, was applied to the opening, and kept in its place by four strips of brass secured to the heads, on which a rectangular frame, having the surface next to the glass accurately ground, was secured; the pressure of the steam keeping the glass against this frame, closed the boiler. Fractures occurring frequently from the rapidly varying, and often considerable, pressures within the boiler, and taking place by pressing the middle part outwards, as was proved by examining the fractures, frames with cross bars, see figs. 2 and 3, having the interior surface carefully ground, were used. The difficulty of properly adapting the surface of these frames to the glass having been removed, they were used in the later experiments, and were found to afford a sufficiently good view of the interior of the boiler, notwithstanding the obstruction by the cross bars.

Three gauge cocks were placed in the front head of the boiler; their positions will be particularly stated hereafter; they are shown in figs. 1 and 2, at *a*, *b*, and *c*.

To the same head, and by the side of the gauge-cocks, a glass water-gauge (*x*, *x*, figs.

* The end-views will be given in our succeeding Number.

Fig. 4.



1 and 2) was attached, a particular description of which will be given in the detail of experiments made to compare its performance with that of the gauge-cocks.

To supply the boiler with water, a forcing-pump EE′ FG, figs. 1 and 3, was placed near the back-end. This pump was of the ordinary construction, with a solid plunger and conical valves; the diameter of the pump was one inch, and the play of the piston one inch and three quarters. The diameter of the pipe F G, by which the water was conveyed from the pump to the boiler, was three hundredths of an inch. By a coupling-screw this pipe could be connected with either of the stop-cocks *d e*, fig. 3, in the back-end of the boiler: the opening of these cocks was two hundredths of an inch in diameter.

To ascertain the elasticity of the steam within the boiler, a closed steam-gauge (H, figs. 1 and 3) was used, a particular description of the construction, &c. of which will be given. This instrument was placed upon the same stand (I, figs. 1 and 3) which supported the pump, so that the same experimenter could observe its indications and attend to the working of the pump. The cistern of the gauge was connected by a flexible pipe *f g* with the upper part of the boiler.

The safety-valve is shown on the top of the boiler (K, fig. 1), midway between the heads. The graduation of it required much pains, and will receive a separate discussion.

Near the safety-valve is represented at L, figs. 1 and 3, the fusible plate apparatus, consisting of a sliding-plate of iron, moved by a lever. On the other side of the safety-valve are the thermometers M and N, fig. 1, plunged *into iron tubes to give* the temperature *of the steam and water within* the boiler. Above this appears the reservoir O, containing the water intended to maintain the scales of the thermometers at a constant temperature. All these parts require a more detailed description.

DETAILS OF THE APPARATUS.

Of the Steam-Gauge.

The steam-gauge consisted of a glass tube closed at the upper, and open at the lower end, which passed steam-tight into a reservoir for mercury: when this reservoir was connected with the boiler, the pressure of the steam raised the mercury into the gauge-tube, compressing the air which the tube contained. The first mercurial-gauge which was made was broken by a sudden access of surcharged steam, in the experiments upon that subject, and was replaced by a second one. The method of graduation, and, in general, the description of the second gauge, will serve also for the first; the details, only, varied slightly.

The glass gauge-tube was 26·43 inches in length. To the lower end was connected an iron ferule, terminated above by a projecting ring. This ring was pressed upon the upper end of the pipe *h*, fig. 1, by a coupling-screw, which served to form a tight juncture between the gauge and the cistern. The cistern *i* was a cylindrical vessel of cast-iron, having the two projecting tubes *h* and *k*, upon which screws were cut; the first of them has been alluded to as giving a passage to the glass tube of the gauge; the second was coupled by the pipe *f g*, figs. 1 and 3, to the boiler.

The gauge-tube was not of precisely equal diameter throughout, and it was judged more accurate to graduate small portions of it into equal volumes. This was done by intro-

ducing equal measures of air from the point of a sliding-rod gas-measure (Hare's); this operation was performed repeatedly, and by multiple measures to verify the results, until the marks made for the equal volumes, on a paper scale attached to the tube, coincided, in the various trials. The lengths of the spaces occupied by the equal volumes were then carefully measured upon the brass scale to be used with the gauge. The slight differences between the lengths given by adjacent parts of the tube, showed that it might be considered as divided into so many small portions of uniform diameter. The mercury rising into the gauge-tube from the cistern when pressure is applied, the level of the cistern is necessarily depressed; the amount of the correction for this depends upon the relation between the areas of the cistern and tube, supposed uniform. The areas of the cistern were found to be, within the limits of its use, sensibly the same; those of the tube might be so assumed for such a purpose: the ratio was, therefore, found by filling the gauge-tube with mercury, and pouring this into the cistern, noting the rise produced; comparing this with the mean length of the tube, the ratio of depression in the gauge for elevation in the tube was found to be as ·01 to 1. The air within the tube was next carefully dried by the introduction of a receptacle of chloride of calcium, of the same length with the tube;* the air having been in contact with this substance for a sufficient time, the receptacle was withdrawn through the mercury over which the drying had been effected; the tube was next placed over a dish of mercury, in the receiver of an air-pump, and the air withdrawn until on re-admitting air to the receiver the mercury rose in the tube above the iron ferule.

The gauge-tube was next introduced into the cistern, the level of which corresponding to the zero of the brass scale was then arranged, and the point of the scale at which the mercury stood was ascertained, the barometer and thermometer being noted.

It was intended in the experiments to keep the pipe from the gauge to the boiler cool, so that it might contain water, and thus give a nearly constant pressure upon the mercury of the cistern,† besides preventing the exposure of the apparatus to heat; the height of this column, above the level of the cistern, was therefore ascertained, after the gauge was put in place by screwing the cistern *i* to the stand.

All the elements for calculating the elasticity of the steam within the boiler, from the height of the mercury of the gauge, were thus known; the temperature of the apparatus being supposed constant.

The elastic force of the steam within the boiler, together with the column of water in the steam-pipe, balances the elasticity of the compressed air within the gauge, together with the column of mercury above the level of that in the cistern. This level is not the original zero, but lower than that by the depression produced by the rise of mercury in the gauge-tube. The depression of the mercury changes the level above which the pressure of the column of water in the steam-pipe is measured, but the change in the pressure by the column of water is altogether inconsiderable. The law of the elastic force of dry air, which has been recently shown, by Dulong and Arago, to be accurate, at pressures from one to fifty atmospheres, was made use of in determining the elasticity of the air in the gauge: this elasticity is inversely as the space occupied by the air. From the data already obtained, and upon the principles just stated, a table was calculated by which the observed heights of the gauge were converted into the corresponding pressures in inches of mercury or in atmospheres. The calculations were rendered rather tedious by the unequal diameter of the bore of the tube, on account of which equal lengths did not correspond to equal volumes. The usual method of calculation was resorted to, namely, to determine, by rigid calculation, the pressures, for points sufficiently near each other, and then to interpolate for intermediate heights.

The foregoing remarks take for granted that the temperature of the air in the gauge, as well as that of the mercury, remains constant; to secure this, an arrangement was adopted similar to that employed by Dulong and Arago for the same purpose. The gauge and scale were surrounded by a glass tube *l*, figs. 1 and 3, cemented below into a brass cap *m*, fig. 1, which had an opening in the side, communicating with a discharge-pipe *n*, figs. 1 and 3. The tube was attached above by an air-tight juncture to a tin vessel P, of considerable capacity compared with the tube. Water being introduced into the glass tube surrounding the gauge, the flow through this tube was regulated by a stop-cock *o*, placed at the end of the discharge-pipe, the cistern above being filled with water.

To ascertain the temperature of the column of water surrounding the gauge, a ther-

* By this method, each volume of air in the tube was in contact with nearly a twelfth of its bulk of the chloride.

† This and very many of the other precautions to insure accuracy, are borrowed from the able memoir of Dulong and Arago on the elastic force of steam at different temperatures; the result of their labours as members of a Committee of the French Academy. Those who have engaged in questions of research will know that too great care cannot be taken to prevent the introduction of error, even in researches *where great nicety may not be considered essential.*

mometer p, fig. 3, with a very small bulb, was attached to the scale at the middle of its height: by this instrument, the flow of water through the casing of the gauge was regulated so as to keep the temperature nearly constant, and any deviations from a constant temperature were ascertained and noted, that the proper correction might be applied. The correction for the expansion of the air in the gauge, by a rise in its temperature during the progress of the experiments, was made according to the rules furnished by the rate of expansion of the gases, as determined by Gay Lussac, extended to compressed air by the experiments of Davy.* The correction for the changes of height of the mercurial column, within the range to which the temperature was suffered to increase, could not have been appreciable if acting entirely, and the counteracting effect of the expansion of the glass further justified its being neglected. For similar reasons, no reference was made to the effects of heat on the mercury in the cistern i, on the cistern itself, and on the water within the pipe communicating with the boiler.

On the Thermometers.

In most of the researches of the Committee, refinements in the mode of using the common thermometer would have been out of place. Results which might be obtained with little additional labour, and which would be interesting in both a practical and scientific point of view, were not to be neglected, and to some of them great accuracy was essential. In the questions of the first class the thermometers were provided with wooden scales, and were graduated by immersion up to the point at which the scale commenced, the scale and upper part of the tube being exposed to the air; this was proper, as they were intended to be immersed in mercury nearly up to the scale. These instruments were examined after coming from the makers' hands, and the instrumental error ascertained. The tubes in which the thermometers were placed, and which contained mercury, were at first placed horizontally in one of the heads of the boiler; this had the advantage of rendering the tube for indicating the temperature of the water entirely independent of the steam, and thus any difference between the temperature of one and the other might be more effectually ascertained than when the tube giving the temperature of the water passed through the steam. The position of these instruments interfered so much with other parts of the apparatus, and so much inconvenience and danger of error was experienced from the separation of the column of mercury in the thermometer, that these tubes were not used after the first weeks of experiment, and two vertical tubes, placed as already shown, were substituted for them.

The thermometers used, when the relation between the temperature of the steam and water, and the elasticity of the steam were to be observed in conjunction with some of the subjects more directly under the cognizance of the committee, had much pains bestowed upon them.

The scales (M and N, fig. 1,*) were metallic, and surrounded by glass tubes, fitting into a cup, a', through the bottom of which the stem of the thermometer passed watertight; a pipe, $b'\,c'$, fig. 2, from the side of

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* Let e represent the elastic force of the air within the gauge-tube, expressed in inches of mercury; let h be the height of the mercurial column above the original zero; h', the height of the column above the new level; a, the height of the column of water in the steam-pipe above the zero; s, the specific gravity of mercury; t, the tension of the steam within the boiler, in inches of mercury. Then $h'-h$ is the depression in the cistern caused by the rise of mercury in the gauge, and $a+h'-h$, the height of the column of water in the steam-pipe above the new level in the cistern. We have then,

$$e+h+h'-h-\frac{a+h'-h}{s}=t.$$

For the gauge in question, $h'-h=\cdot01\,h$, $a=17\cdot5$ inches, also $s=13\cdot6$; then

$$e+1\cdot01\,h-\frac{17\cdot5}{13\cdot6}-\frac{\cdot01\,h}{13\cdot6}=t, \text{ or } e+1\cdot01\,h-1\cdot29-\cdot0007\,h=t;$$

the term $\cdot0007\,h$ may be neglected as inconsiderable, since for $h=24$ inches, this term is only $\cdot0163$. The equation then stands,

$$e+1\cdot01\,h-1\cdot29=t.$$

At the temperature of 48°, and at a mean pressure, the observed value of h was 3·23; of course, $e=26\cdot77$. The volume of the air in the gauge was 8·63.

To find the elasticity for any other height, h', find from the data relating to the volume of the air in the gauge, the new volume; call this v', and the elasticity due to it e'; then:—

$$v:8\cdot63::26\cdot77:e'; \text{ and}$$
$$e'+1\cdot01\,h'-1\cdot29=t.$$

To introduce the correction for temperature, since the elasticity produced by an increase of temperature corresponds with the expansion produced, and since the expansion of condensed air follows the same law as that of air of ordinary density, expanding $\frac{1}{480}$th of its bulk at 32°. for each additional degree of Fahr. above this point, or $\frac{1}{496}$th of its bulk at 48°; calling e'' the elastic force of the heated air, e' that of the same air at 48°, n being the number of degrees of heat above 48°.

$$e''=e'+\frac{n\,e''}{496}=e'\,(1+\cdot002\,n)$$

whence, since $e'=\dfrac{8\cdot63\times26\cdot77}{v'}$,

$$\frac{231\cdot02}{v'}\cdot(1+\cdot002\,n)+1\cdot01\,h'-1\cdot29=t.$$

* In fig. 2, thermometer N, to render it conspicuous, is shown, as if the scale were turned to the front of the boiler.

each cup, and provided with a stop-cock, d', regulated the flow of water through the enveloping tubes: a tight connexion above, with a reservoir, (O, figs. 1 and 3,) served, as in the case of the gauge, to supply the tubes with water. Small thermometers on the back of the scale of the large ones, showed the temperature of the water which surrounded them. The enveloping tubes being filled with water at 60°, the position of the boiling point of water and of the fusing point of tin, were used to verify the accuracy of graduation. The latter point, which is high upon the scale of the thermometer, having been very accurately determined, and being easily and with certainty ascertainable, serves as an excellent check upon the graduation. The greatest error within the limits just stated, was, in one instrument, three-fourths of a degree, and in the other one degree of Fahrenheit. The scales were graduated from two to two degrees, one quarter of a degree being readily estimated upon them. The corrections required by this examination were made through the medium of a table prepared for the purpose. In order to call the attention to the temperature of the water surrounding the scales, this temperature was recorded from time to time, when the height of the thermometers was observed. At no time did the rise of temperature, permitted in the water, make it necessary to apply a correction for the expansion of the scale.* None was required for the cooling effect of the water around the stem upon the mercury, owing to the method of verifying the scale.

The other parts of the apparatus, less general in their use, as the water-gauge, safety-valve, fusible plate apparatus, &c., will be more conveniently described in connexion with the experiments for which they were devised.

Subjects of Investigation.

The queries originally proposed, together with the new matters, which were made the subjects of experiment, will be treated in the following order:—

I. To ascertain whether, on relieving water heated to, or above, the boiling point from pressure, any commotion is produced in the fluid.

* Including the examination of the efficacy of the common gauge-cocks, of the glass gauge, and of Ewbank's proposed gauge-cocks.

The investigation of the question whether the elasticity of steam within a boiler may be increased by the projection of foam upon the heated sides, more than it is diminished by the opening made.

II. To repeat the experiments of Klaproth on the conversion of water into steam by highly heated metal, and to make others, calculated to show whether, under any circumstances, intensely heated metal can produce, suddenly, great quantities of highly elastic steam.

First, The direct experiment in relation to the production of highly elastic steam in a boiler heated to a high temperature.

Not to interrupt the general train of investigation which follows a well known theory of explosions of steam-boilers, the results of the experiments on the former part of this query are inserted in another place.

III. To ascertain whether intensely heated and unsaturated steam can, by the projection of water into it, produce highly elastic vapour.

IV. When steam, surcharged with heat, is produced in a boiler, and is in contact with water, does it remain surcharged, or change its density and temperature?

V. To test, by experiment, the efficacy of plates, &c., of fusible metal, as a means of preventing the undue heating of a boiler, or its contents.

1. Ordinary fusible plates and plugs.
2. Fusible metal, inclosed in tubes.
3. Tables of the fusing points of certain alloys.

VI. To repeat the experiments of Klaproth, &c.

1. Temperature of maximum vaporization for copper and iron under different circumstances.

2. The extension to practice, by the introduction of different quantities of water, under different circumstances of the metals.

VII. To determine, by actual experiment, whether any permanently elastic fluids are produced within a boiler when the metal becomes intensely heated.

VIII. To observe accurately the sort of bursting produced by a gradual increase of pressure, within cylinders of iron and copper.

IX. To repeat Perkins' experiment, and ascertain whether the repulsion stated by him to exist between the particles of intensely heated iron and steam be general, and to measure, if possible, the extent of this repulsion, with a view to determine the influence it may have on safety-valves.

X. To ascertain whether cases may really occur when the safety-valve, loaded with a certain weight, remains stationary, while the confined steam acquires a higher elastic force than that which would, from calculation, ap-

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* Upon the scale of one of these instruments there were 314° in 6 inches. Brass expands $\frac{1}{532}$ds of its length, from 32° to 212°. These 6 inches, at 32°, would become 6·0113 at 212°. Ten degrees upon the scale would become 9·99 by a variation of temperature from 32° to 212°, a diminution of only ·01 *of a degree for a variation of 180° in the temperature of the scale. In practice, the variation never exceeded thirty degrees.*

pear necessary to overcome the weight on the valve.

XI. To ascertain by experiment the effect of deposits in boilers.

XII. Investigation of the relation of the temperature and pressure of steam, at ordinary working pressures.

Table from 1 to 10 atmospheres.

I. To ascertain, by direct experiment, whether on relieving water heated to, or above, the boiling point, from pressure, any commotion is produced in the fluid.

The first experiments on the effect of relieving water in ebullition from pressure, were made in a glass boiler; here the fire was under the whole length of the boiler, which was a cylinder of fourteen and a quarter inches in length, and seven and a half inches in diameter. The steam within, being at a pressure of less than two atmospheres, by opening a cock at the end of the boiler, or the safety-valve, also at the end, large bubbles were formed through the whole extent of the boiler.

The inquiry was prosecuted in the iron boiler already described, a distinct view of the interior being had through the glass windows placed in the heads. The greatest intensity of the fire was in front of the middle of the boiler, and extended through about one-third of its length: the part immediately near the flue, was next to this band in temperature. With this boiler experiments were made, which showed, that on making an opening in the boiler, even when the pressure did not exceed two atmospheres, a local foaming commenced at the point of escape, followed soon by a general foaming throughout the boiler, the more violent in proportion as the opening was increased. This small boiler was completely filled with foam by opening the safety-valve (nearly two-tenths of an inch in area), which was placed on the middle of the top, and the water violently discharged through the opening of the valve. The area of the valve bears to the horizontal section of the boiler, at the water line, the ratio of one to two thousand and fifty-five nearly.

The boiler was half full of water in these experiments. The gauge fell always on making the opening.

The foaming, which was so repeatedly observed, must be produced in a greater or less degree every time that steam is drawn from a boiler to supply the engine; every time that a gauge-cock is opened, or the safety-valve raised. It is interesting in two points of view; first, in its effects upon the apparatus designed to show the level of the water within the boiler; second, by its throwing the water against the heated sides of the boiler.

Gauge-cocks and Glass Water-gauge.

The apparatus most commonly used in our country for determining the level of the water within a boiler, consists of three gauge-cocks attached to the boiler head, one of them being at the water level, and the others equally distant above and below that level.

These cocks in the experimental boiler, *a b c*, figs. 1 and 2, were 1·95 inches and 1·8 inches apart, measuring from the centre of the opening of the middle one, to the one above and to the one below.

The steam in the boiler being not higher than two atmospheres, the following experiment was made:—The level of the water was reduced until it stood just below the lowest gauge-cock. On opening this cock, steam at first flowed out, then water and steam; on opening the second cock, in addition, water flowed freely from the lowest, which was above the hydrostatic level; the foaming within the boiler, which was produced by thus relieving the pressure, was distinctly seen through the glass windows. On opening the third cock, steam and water issued from the second, which was two inches above the water level; and on partially raising the safety-valve, water flowed freely from the second cock. A further rise of the valve filled the boiler with foam, water flowed freely out of the third cock, more than three inches and three-quarters above the water level, and finally through the opening of the safety-valve itself. In these experiments, an opening of ·03 of a square inch in area, the lowest cock, which, to the area of the water surface, was as one to thirteen thousand seven hundred, cause water and steam to issue through a cock, below which the water was known to be. A further opening of ·03 of a square inch, making, with the first, ·06 inch, or one six thousand eight hundred and fiftieth the area of the water surface, brought water from the lowest cock; a total opening of ·09 inch ($\frac{1}{4567}$th of the area of the water surface), brought water and steam from the middle cock, indicating that the level of the water was nearly two inches higher than it really was.

A first apparatus, which was contrived for applying fusible plates to the boiler, suddenly opened an aperture of ·95ths of an inch in diameter. Even at low pressures, the scalding contents of the boiler were violently discharged, through this opening, against the roof of the experiment house.

It is time now to speak of the glass gauge-tube, as a means of indicating the level of the water within a boiler, in connexion with which an experiment bearing upon the performance of the gauge-cocks will be stated.

The form given to the water-gauge, on its

first trials, was that described to the Committee by Mr. Hartshorne, of Cincinnati. This was a prismatic box of brass, of suitable dimensions; one face of which was supplied by a glass plate; this box, being put in communication with the boiler, by two pipes, one entering from the steam, the other from the water, the level of the water was seen through the glass plate. This apparatus was attached to the experimental boiler, and its indications compared with those of the gauge-cocks in the experiments already detailed. On relieving the water from pressure, the water within the gauge was agitated; during the further foaming its oscillations did not amount to half an inch, so that the hydrostatic level was truly shown by it; and further, on closing the openings, the fluid in the gauge became tranquil at the mean level of its oscillations, showing that it had fallen with the fall of the water within, caused by the escape of steam. An instructive experiment to the same purport was made on the occasion of a fracture in one of the glass windows, described as placed in the ends of the boiler. The account taken from the minutes of the day's experiments is as follows:—

The temperature being at 292° Fahr., and the pressure indicated by the gauge four atmospheres, the north window of the boiler, which had a flaw in it, cracked across the middle, and nearly horizontally; steam issued slowly through the crack; on looking into the boiler a foaming at the end where the steam was escaping was observed. The crack rapidly enlarging, the steam issued in quantities through it; the water was in general agitation throughout the boiler, running out at the crack, though its hydrostatic level was at the bottom of the window, about one inch and a quarter below the crack, and being distinctly seen at the opposite window, foaming near the top of the glass; the water-level gauge began to fall, oscillating not half an inch in its fall. The safety-valve was now opened by hand, so as to waste the water with great rapidity. The water still issued through the crack, the water-level gauge falling. On closing the valve the water settled down, becoming comparatively tranquil; the water-gauge remained at the same level: it had, therefore, indicated constantly the true level unaffected by the foaming, except in slight oscillations.

In fact, this gauge shows truly the height of the water within the boiler, until the foam rises so high as to pour over through the upper connecting tube. The idea was suggested that by placing the gauge-cocks in a prism, connected above with the steam, and below with the water in the boiler, the true level of the water would be indicated. Such a cock was, therefore, applied to the box of the water-gauge; its opening produced a local foaming in the gauge, which brought water through the cock, although the true level was much below it. The area of this cock was nearly equal to the area of that which opened into the steam chamber of the boiler.

In relation to the form of the water-gauge, as already described, it does not seem to offer as many advantages as the tube which has been adapted to the boilers of some of the English locomotive engines.* The glass plate requires the support of horizontal bars, which are objectionable, or it must be reduced so much in breadth that the level is obscurely seen through it; the strain upon the plate being unequal, it is very liable to fracture; such fractures repeatedly took place near the centre of the plates in the gauge used by the Committee.

To the use of the glass gauge for the high-pressure engine, an objection occurs, from the effect produced by high steam upon the glass, apparently by its action on the alkali; by which the transparency of the glass is gradually destroyed. A similar effect was recorded by Cagniard de Latour, in his experiments on liquids at high temperatures, confined in glass tubes.† As far as the experiments of the Committee have gone, they show that green glass is not so readily injured; and as it is easily procured in tubes, a further reason appears for preferring the tube in practice, to the plate.

An attempt which was made to substitute windows of mica in the boiler for those of glass, bears upon the use of that mineral for the plate of the water-gauge; as does also another attempt which was made to protect the glass plates by a lamina of that mineral. The mica exfoliated under the action of the steam which insinuated itself between the laminæ through cracks which were invisible, if existing, before the experiment, or which may have been produced by the steam itself; the laminæ were separated, and thus the steam quickly found a more or less direct passage through the plate.

The tube-gauge which was substituted for the prism is shown in figs. 1 and 2. *w x* is the tube of green glass passing into the

* The application of such a gauge to a locomotive-engine can give but little idea of its use for a stationary engine. The jarring in the locomotive must constantly expose the gauge to fracture, and perhaps may prevent its use. The glass water-gauge has been adopted in at least one of the boats plying between New York and Amboy, New Jersey, belonging to Messrs. Stevens; and the Committee understands, are also in use upon their locomotive-engines.

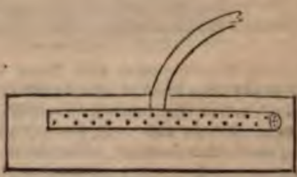
† See also recent experiments on the action of water at high temperatures upon glass, by Professor Turner, of the University of London. Royal Society's Trans. for 1834.

stuffing-boxes, w' and x'; the stuffing enables an adjustment to be made for the unequal expansion of the glass and metal by heat, and prevents fracture on the subsequent cooling of the apparatus. y and z, fig. 1, are passages connecting the tube with the boiler; these have conical terminations, by which the pipe is readily attached to, and detached from, the tubes y and z, which are screwed into the boiler, and are provided with stop-cocks: coupling screws might, in practice, be substituted for these conical terminations. To protect the tube, $w\,x$, from currents of air, it was surrounded by a second tube, loosely applied. A scale was attached to $w\,x$, to indicate the level of the water within the boiler. The tube being transparent, shows the level of the water more readily than it can be seen in the prism before referred to, which was opaque on three of the vertical sides.

The gauge used was nine inches and three-quarters in length. The upper part being so near the top of the boiler as only to be affected by the foaming, in extreme cases; the lower part so near to the bottom that the level of the water was indicated, unless when very low indeed.

The position of the lower communication of the gauge with the boiler soon showed a defect, to which the instrument must be always more or less liable, namely, to the obstruction of the lower passage by sediment. To remedy this, a stop-cock was attached to the lower part of the gauge, as at x', fig. 1, and through it, when open, water could be blown, by the pressure of the steam in the boiler, so as to remove any obstruction. This method is to be preferred to that of closing the upper communication with the boiler, while the lower one remains open; in which case the sediment is driven up into the glass tube, soiling it, accumulating there, and affording only a temporary remedy. When the obstruction in the pipe is not removed on opening the cock, a wire inserted will effectually clear the passage.

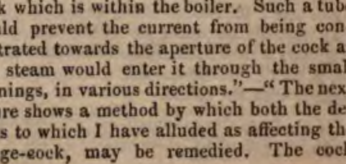
In connexion with this subject, the Committee experimented upon the method proposed by Mr. Thomas Ewbank, of New York, for lessening or preventing the foaming here stated to occur. The remarks of Mr. Ewbank are to the following effect:—"When steam is raised in a boiler, and the engine not working, the water within (if the flues are sufficiently covered) is probably on a level and nearly at rest; but as soon as the steam is admitted into the cylinder, it causes an ebullition of the water, which rises towards the mouth of the steam-pipe, in consequence of the *portion of the pressure upon it being suddenly removed* at every stroke of the piston. This might, I think, be prevented by continuing the steam-pipe an inch or two into the boiler, and then branching it off towards each end of it, with small apertures in its sides and ends, as in the diagram.



In this manner the steam would be equally withdrawn from every part of a boiler, instead of being violently agitated in rushing to one place. Such a tube attached to the aperture of a safety-valve, would be equally advantageous; or the valve might be placed on one end of the tube leading to the cylinder.*

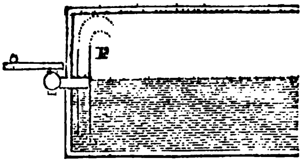
"The inaccuracy of the common gauge-cock as a means of detecting the true height of the water in a boiler, arises chiefly from two causes; firstly, from the agitation of the water while steam is being withdrawn from the boiler to supply the engine, or through the safety-valve; and, secondly, from the current or rush of steam produced towards the aperture of a gauge-cock when it is open; in consequence of which the water, though previously at rest, is agitated and carried out through it.

"The last-mentioned defect may be lessened by a perforated tube (see the accompanying figures) attached to the end of the



cock which is within the boiler. Such a tube would prevent the current from being concentrated towards the aperture of the cock as the steam would enter it through the small openings, in various directions."—"The next figure shows a method by which both the defects to which I have alluded as affecting the gauge-cock, may be remedied. The cock

* Journal of the Franklin Institute, vol. ix. p. 366, 1832, letter from Thos. Ewbank, Esq. of New York, to the Committee on Explosions.



passes through the head of the boiler in the usual way, and is then united to a perpendicular pipe, open at both ends, and about two or three inches in diameter. The lower end of the pipe is four or five inches below the surface of the water, and its upper end is carried as far above the level as may be convenient."—"When this cock is opened no current can be formed in the direction of its aperture, and the water in the tube P (which will, of course, be at the general level of the water in the boiler) will not be so subject to agitation."*

To test the idea that the foam which issues through the gauge-cock is produced by a rush of steam towards the aperture, and the method proposed by Mr. Ewbank for lessening it, tin pipes, ten inches and three-eighths in length, and three-eighths of an inch in diameter, with seventy-nine perforations, each about two hundredths of an inch in diameter, were attached to the central and lowest gauge-cocks *b* and *c*, fig. 1. When the level of the water within was about five-eighths of an inch below the cock *c*, or nearly two inches and four-tenths below the cock *b*, on opening the lowest cock, the steam being at a pressure of two atmospheres and two-tenths, a very little water mixed with the steam, passed through the opening of the cock; on opening the middle cock *b*, water and steam flowed through *c*; on closing this and opening the highest cock *a*, less water issued through *c*. When both *a* and *b* were opened, the water flowed copiously through *c*. At the close of this experiment, the glass water-gauge showed that the level of the water within the boiler was one inch below the lowest cock.

In another experiment the water being one inch and a half below the lowest cock; *c* being opened, no water issued; *c* and *b* being opened, a very little water issued through *c*; *a*, *b*, and *c*, being opened, a little water was mixed with the steam.

The facts thus elicited are in accordance with the preceding observations of the Committee in relation to the general foaming which takes place when an aperture is made in any part of the boiler. The great respect which they entertain for the ingenious author of this device, on account of the valuable contributions which he has made to them, induced them to give this full trial of his suggestion.

The third form of apparatus would cut off the access of water from the general foaming, until it reached the level of the lowest apertures; but it would substitute a local foaming which would effectually, if not equally, prevent the true hydrostatic level from being indicated: in this respect it is nearly equivalent to the gauge-cock, already described, as applied to the water-gauge.

Alarm Floats.

The various floats which have been applied to show the level of the water within a boiler are well known. They have never obtained favour in this country, and are considered particularly objectionable in their application to the high-pressure boiler, on account of the motion within. The stuffing-box, commonly used to pass the index-rod of the float through the top of the boiler, is objectionable, and different devices have been originated with a view to remedy this difficulty. That of Mr. Thomas Ewbank, of New York, described in volume xvi. of the *Journal of the Franklin Institute*, is highly ingenious, and is reported by him to have stood the test of experience in his small boiler, producing steam of rather less than five atmospheres. The apparatus of the Committee did not furnish facilities for a proper trial of this float; and, besides, such a trial would be inadequate to test its use in practice.

A float serving to give an alarm by the issuing of steam, was made the subject of a few experiments, and answered well, as far as those trials went. Long use, however, could alone determine, perfectly, the peculiar liabilities to derangement in this apparatus. The float alluded to is shown on fig. 4 (p. 83). The requisite buoyancy is given to the metallic pyramid *a*, which is solid, by the weight *b*, acting as a counterpoise over the fulcrum *c*. The whole apparatus is attached to the top of the boiler by the screw *d*, and the nut *e* and the working parts are thus entirely within the boiler. When the water is at the proper level *f g*, the shoulders *h* and *i* are in the same horizontal line, and the disks *k l*, which are pressed against the shoulders by two springs shown in the figure, close the apertures *k m*, and *l n*, which, when open, permit steam to escape from the boiler. Should the water sink below its proper level, the equili-

* Journal of the Franklin Institute, vol. x. pp. 80, 81; 1832. "Supplement to the communication of Thomas Ewbank, Esq. of New York, to the *Committee on Explosions*."

brium of the pyramid *a* being destroyed, the shoulder *i* would press against the disk *l*, remove it from the aperture, and permit steam to escape through *l n*; should the water, on the contrary, rise above the proper level, steam would escape through *k m*. The force of the springs which close these openings, should, of course, be duly proportioned, as they will determine the sensibility of the apparatus. The details of construction are clearly shown in the figure, which is drawn to a scale.*

The quantity of steam which would escape by the small opening *l n*, while it would serve as an alarm, would not materially diminish the supply of water within the boiler. The float used by the Committee was found to be sensible to less than three-tenths of an inch in the change of level; it could have been made more sensitive by increasing the breadth between the shoulders, so as to bring them in contact with the disks, as shown in the figure.

Effect of Foaming on the Elasticity of the Steam within the Boiler.

This point was the next proposed for examination. When an opening is made in a boiler, of which the sides are head, will the effect be to diminish the elasticity of the steam within, by permitting its escape, or will the water thrown upon the heated sides by the foaming which results, be converted so rapidly into steam as actually to increase the elasticity of the vapour within? It is obviously difficult to obtain an answer to a query involving so many conditions. It might be expected, however, that a small boiler would afford satisfactory means of making a fair trial of the question, since the size of the openings could be varied very easily, so as to make them comparatively small, or very great. The position of the boiler used by the Committee in its furnace was such, that the sides could be very readily heated; thus placing it in favourable circumstances to increase the elasticity of the steam by producing a foaming within. The apparatus was therefore adapted to make the desired trial.

M. Arago, in his Essay on the Explosions of Steam-boilers, states, that MM. Tabareau and Rey, at Lyons, found on opening a large stop-cock, connected with a small high-pressure boiler, that the safety-valve rose, showing an increase of pressure within. The boiler was placed naked upon a fire of charcoal, and the part not containing water was surrounded by flame. The experiments of MM. Arago and Dulong, at Paris, were attended with a contrary result, the opening of a safety-valve being always accompanied by a diminution in the elasticity of the steam within. The circumstances, however, were not the same as those in the experiment of MM. Tabareau and Rey.

To repeat this experiment, a hot fire was made beneath the boiler, and when the water had fallen to about three inches above the lowest line of the cylinder, the experiment was commenced, the pressure being about three atmospheres and a half. A stop-cock of ·03 sq. inches in area, $\frac{1}{10960}$th part of the area of the water surface at the beginning of the experiment, delivering per second, at three and a half atmospheres, about four hundred and nine cubic inches of steam was first opened; next the safety-valve was raised, either in part or entirely, the area when entirely raised, being ·208 sq. inches, or $\frac{1}{1580}$ths of the water surface, and capable of delivering, in one second, at three and a half atmospheres, a bulk of steam nearly nine times that of the steam chamber. The water level falling by the waste caused in the experiments, the steam soon became surcharged with heat; and the iron of the boiler, from near the water line to more than one-third of the distance from the lowest line to the middle of the convex surface, became, on each side of the water-line, heated until it attained redness, passing, of course, through the temperature of maximum vaporization of the water thrown by the foaming upon the iron. The experiments were made at intervals, until all the water was exhausted. Water was then injected in small quantities, and with the bottom of the boiler for the most part red hot, the trials were repeated.

It will be seen from the following table, that the result was uniformly a diminished elasticity of the steam within, as shown by the fall of the mercury in the steam-gauge. The pressures varied, in the former part of the experiments, from three and a half to eight atmospheres.

The first column of the table contains remarks referring to the level of the water within the boiler. The second to the opening made. The third is the temperature indicated by the thermometer, M, fig. 1, before referred to, as passing nearly to the bottom of the boiler. The fourth, the height of the mercury-gauge, before making the opening. The fifth, the height immediately after making the opening, unless the contrary is stated in the sixth column, which contains remarks relating to the effect on the gauge. The seventh column contains general remarks.

* In the figure, the shoulders *h* and *i*, do not rise high enough; they should overlap the disks more, that no depression *or elevation* of the water may *carry them clear of the disks.*

The thermometer at first indicated the temperature of the water, then that of the surcharged steam, and finally was affected by the heat radiated from the bottom of the boiler.

Remarks on Depth of Water.	Nature of Opening.	Temp. by long Ther.	Height of Steam-Gauge.		Remarks on the Depression of the Steam-Gauge.	General Remarks.
			Before.	After.		
		Fahr.°	Inches.	Inches.		
3 inches,	Gauge-cock,	$284\frac{1}{2}$	18·6	18·0		Temperature of air in gauge, 80°.
	Do.		20·4	20·2		Pressure corresponding to 18·6 inches, $3\frac{1}{2}$ atmospheres.
	Safety-valve,		20·5	20·0	Fall very rapid.	
	Gauge-cock,		21·0	20·9	Fall immediate.	
	Safety-valve,		21·3	21·0		Pressure corresponding to 21·3 inches, $5\frac{1}{2}$ atmospheres.
·9 of an inch,	Gauge-cock,	$317\frac{1}{2}$	21·9	21·8		
	Safety-valve,		22·1	21·7	Fall in $\frac{1}{2}$ second.	
	Do.		22·6	20·6	Fall in 2 seconds.	From about $8\frac{1}{3}$ to 5 atmospheres.
·9 inch nearly,	Stop-cock,	380			Falls.	Steam surcharged—bottom rapidly increasing in heat.
	Safety-valve,	$468\frac{1}{3}$	15·1	12·6		
	Gauge-cock,		18·0	14·0		Water exhausted, supply thrown in.
	Safety-valve,		16·0	14·0	Sudden descent.	Thermometer rose to 600°.

(To be continued.)

MACKINTOSH'S ELECTRICAL THEORY OF THE UNIVERSE.

Sir,—Whilst residing in Paris (from which capital I have lately arrived), my attention was directed by M. de la R——, Member of the French Institute, to a theory of the solar system which, if I am rightly informed, appeared originally in the pages of the *Mechanics' Magazine*, and upon which, with your permission, I would offer a few observations.

In the first place, I would remark, that Mr. Mackintosh has, by referring all motion to the agency of electricity, attempted more than the present state of our knowledge, or the arguments which he has advanced in support of that proposition, will sustain. That electricity *may* be the *primary* cause of all motion, I will readily admit; but until the field of knowledge has been widened and extended by the *researches of experimental* philosophy, *we have no data whereby* we can satisfactorily determine this point. Before we attempt to build a system, we must lay a solid foundation of facts sufficient to support the superstructure; from a want of this necessary precaution, many a fine system has tumbled to pieces.

In the concluding part of this theory, I find the following rather formidable sentence:—" We presume that the geometrical demonstrations of the Newtonian philosophy will not be affected, whether we ascribe the effects to the agency of electricity, a power of whose existence we are assured by the evidence of the senses —or whether we refer them to gravitation, a conventional term, adopted for the purpose of explaining a certain effect resulting from no known cause." If by this it is intended to substitute magnetic or electric attraction for that " certain effect" which is generally understood

by the "conventional term" gravitation, whether the cause of this effect may be known or unknown, I presume that the Newtonian philosophy would be thereby affected. However, I see very little reason to apprehend that it *will* be affected by this theory, at least so far as regards that well-known and well-established effect which we understand by the term gravitation. But, on the contrary, I am rather apprehensive that the "*Mackintoshian philosophy*" will be affected by the "conventional term" gravitation; and that it will furnish an objection of such *weight* and validity, as it will not be able to withstand.

These remarks may, perhaps, appear unnecessarily harsh and severe, and, in some measure, uncalled for, as Mr. Mackintosh has introduced his system to our notice in the modest garb of an hypothesis; but when the great truths of philosophy are called in question, I cannot afford to be polite.

However, having freely bestowed censure where it appeared to me that censure was due, I turn with much pleasure to some other points which appear to my mind to claim in an equal degree our praise and admiration. Indeed, it must be allowed that the whole theory has been drawn up with much ingenuity; that there is an air of plausibility, and, in some parts, even probability, about it, which renders it eminently worthy of investigation by the scientific world.

For example, what can appear more plausible than the theory of the two tides when explained upon electrical principles?* The paradox of the tides has always formed a most formidable objection to the doctrine of universal gravitation, to which even La Place himself could never devise a satisfactory answer. But here, by the electrical theory, we find every appearance accounted for in a manner which is at once clear, simple, and beautiful; we find, from the principles laid down, that there *ought to be* TWO TIDES *at the same time*—one on that side which is nearest to the sun and moon, and one upon that which is farthest removed from those bodies which, as we well know, exactly correspond with the actual appearances. Whereas, by the law of universal gravitation, we find that there *ought* to be *one* tide only, and upon that side which is nearest to the sun and moon when those bodies are in conjunction; the second tide, or that on the farthest side, remaining wholly unaccounted for. It must, therefore, be admitted, that the electrical explanation is, in every respect, the most satisfactory of the two. But whilst I readily make this admission, I wish to guard against misconception. I apprehend there would be found some difficulty in explaining upon the same principle why a body near the earth's surface gravitates, or is attracted, if you will, towards the centre of the earth.

It appears, farther, that the tails of comets are accounted for and depend upon the same principle as the tides. The nucleus being negative, is attracted towards the sun—whilst the tail, being positive, is repelled at the same time, its immense length being a necessary consequence of the rareness of the gaseous matter of which it is composed. The appearances do certainly very strongly support this assumption; and also that the tail is continually decreasing in length has been fully verified, at least in one instance, by the late appearance of Halley's comet.

But the most startling part of the hypothesis remains to be noticed. It is presumed, that the earth, the moon, and all the planets, are rapidly posting onwards to universal and certain destruction. That the moon is in every succeeding revolution approaching nearer to the earth, and will finally be precipitated upon the surface of the latter, is certainly a proposition the truth of which is of some moment; but upon the rate of her approach, or the probable time of the final catastrophe, the hypothesis furnishes us with no definite information. I should very much like to see something attempted upon this important point. Could not Iver M'Iver, Mr. Utting, or some of your mathematical correspondents, throw some light upon it? I suppose the redoubtable Mr. John Herapath has withdrawn the light of his countenance from us for ever; we cannot, therefore, expect to be illuminated as heretofore with the refulgence of his transcendant genius.

I intended to have made several remarks upon this part of the theory, but must defer it till another occasion; as to do it any thing like justice, would require more space than perhaps can be conve-

* For this see Mech. Mag. No. 634.—ED. M. M.

niently spared from your valuable pages. I would just remark, that this part carries with it a strong air of probability, and would particularly recommend it to the "perpetual-motion" hunters, those modern alchymists, if any of that wayward tribe still remain. Let them leave their sublime projects in abeyance for a little while, and set about answering the following proposition; before this task is finished, they will probably have discovered that seeking after a perpetual motion is something like a man with a wooden leg running after a hare—the farther he runs the farther he gets behind. The proposition to which I allude is in the following words:* "If there could exist a power having the property of giving continual impulse to a fluid in one constant direction without being exhausted by its own action, it would differ essentially from all the other known powers in nature; all the powers and sources of motion—with the operation of which we are acquainted—when producing their peculiar effects, are expended in the same proportion as those effects are produced." This is certainly a very strong and comprehensive proposition; and furnishes a rule which is, I believe, of universal application. It would thus appear, that this superlative class of mechanical geniuses propose to accomplish more than has been attempted—no doubt for wise purposes—even by the Ruler of the universe himself. I must here close these rather desultory remarks for the present, but shall recur to the subject shortly, as it appears to me to be of considerable importance, and well worthy of investigation.

I remain, Sir, yours, &c.

URSA MAJOR.

* See Mechanics' Magazine, No. 665, p. 233.—ED. M.M.

MR. MACKINTOSH'S ELECTRICAL THEORY OF THE UNIVERSE, AND MR. PINE'S THEORY OF ELECTRO-VEGETATION.

Sir,—Having paid attention for some years past to electrical phenomena generally, I have read with considerable interest an electrical theory of the universe published lately in the *Mechanics' Magazine*, and also the very useful practical observations upon electro-vegetation, by your correspondent, Mr. Pine. I have made some calculations with respect to the electrical theory, which I am afraid are far from being correct, and, perhaps, hardly worthy of a place in your periodical; however, they may be the means of eliciting something better from some of your able correspondents.

Taking 365d. 6h. to have been the true length of the tropical year at the commencement of the Julian period, and comparing it with what is considered to be the correct length at the present day, viz. 365d. 5h. 48m. 52s., we find about 12 minutes due to the earth's secular acceleration in the last 2,000 years. The year contains 525 948 minutes, which being divided by 12 (the quantity due to the secular acceleration), and multiplied by 2,000, gives 87,658,000 annual revolutions of the earth before she falls back into the sun. In the same way, taking 4m. as the quantity due to the moon's secular acceleration; from her mean time as estimated by the observations of eclipses taken at Babylon about 650 years before Christ, and compared with her mean time at the present day, being a period of about 2,500 years, we find that the moon and earth will meet in about 2,700,000 years, and that this event will happen before the earth has advanced more than 3,000,000 miles nearer to the sun. These calculations are founded upon the supposition of the secular acceleration being a constant quantity; but as the velocities of the planets increase as their distances from the sun diminish, the results here given must be very erroneous.

I was fearful, Mr. Editor, upon first reading this theory, that all our fine new railways would shortly be buried in the lunar ruins, and that some of the postdiluvian inhabitants of this earth, if any were so fortunate as to escape, might perchance dig them up and speculate with wonder upon the probable purposes for which they were designed, as we of the present day do with respect to the pyramids of Egypt.——However, it appears there is no *immediate* danger.

I have also a hint or two to communicate relative to electro-vegetation, and should feel obliged if your able correspondent, Mr. Pine, would give his opinion upon them in his next letter. I have observed, that the common scarlet-runner or French bean always twists in

one direction round the stick that supports it; I have often tried to make them turn the opposite way, but never could succeed. It appears to me that this is an effect of electricity. Indeed I am of opinion, that the whole of the clinging tribe of plants are indebted solely to this agent for the support which they derive from the more solid bodies to which they cling. It appears to me, that the delicate tendrils of these plants, when in an active state of vegetation and full of sap, are in a positive state, and are therefore attracted and upheld by the dry bark or other body in their vicinity, which may be in a negative state as compared with the highly active tendrils.

It has been noticed, that it is dangerous to stand under a tree during a thunder-storm; and also, that there is more danger under an ash than there is under those of any other species. It has also been noticed, that no sort of vegetable, but more particularly turnips, will thrive under an ash, even when the tree is entirely isolated and standing in the middle of a large open field. The farmers say, that the droppings from the ash-leaves when it rains *poison* the soil; but I suspect the true cause to be, that the high and spreading branches having a very strong affinity for electrical matter, absorb so large a quantity, that the turnips are deprived of the portion necessary to their proper vegetation. A friend and neighbour of mine, who has paid much attention to this subject, carries his notions considerably farther than I have presumed to go. He gives it as his opinion, that when a field is dressed or manured with lime, although the soil may be enriched to a certain extent, that the augmentation and acceleration of growth which is derived from the soil itself is comparatively trifling, but that a larger quantity of the vegetable nutriment is drawn from the atmosphere, which he attributes, in a great measure, to the chemical and electrical affinities which are called into action by the presence of the lime. In support of his opinion, he says:—"If I were to dress a field with lime, and plant potatoes upon it, I should not expect to have a heavy crop, and for this reason, we know that a heavy crop of potatoes impoverishes the land very much, from which it would appear, that *they* draw their *nourishment principally* from the soil; and as lime is of very little service to this crop, I conclude, that the land is not much enriched by its use. But if I sow barley in this field, I have the chemical action of the lime, aided by the bearded ears of the barley, forming so many thousands of conducting rods, drawing abundant nutriment from the atmosphere, which continually flows over them, charged with particles suited to their nourishment and growth."

With whatever respect these few observations may meet from your readers, I think, Mr. Editor, the subject of electro-vegetation is one of great importance, and lies at the very root of agricultural science. If such of the readers of the *Mechanics' Magazine*, as may have the means of observing, would forward their remarks, that those which appeared valuable might be published, we would thus, by each casting his *mite of knowledge* into the *public treasury*, very soon be in possession of a practical information, and be thereby enabled to extend our dominion over the physical world in all that relates to the means of subsistence, which must be admitted by all to be an object of the highest utility.

Yours obediently,

W. B.

Nottingham, April, 1836.

STEAM CONVEYANCE BETWEEN PADDINGTON AND THE CITY FOR HIRE.

Mr. W. Hancock, whose perseverance certainly deserves success, commenced running his steam carriages, the "Enterprise" and "Erin," on Wednesday morning last, at nine o'clock, from the station in the City-road to London Wall; from thence he proceeded to Paddington, and returned to the City. On the first day he performed three of these journeys, on the second, four, and on the third (yesterday), two, before noon. The average time of travelling over the above ground has been 1 hour and 10 minutes, including stoppages to take in passengers, water, and coke. This is just half the time the horse-omnibuses take in going over the same ground. In the 9 journeys performed, the number of passengers carried was 220, averaging about 12 persons each single trip. Mr. Hancock intends to run his carriages regularly the same number of journeys daily, for the present, and very shortly to increase the number.

NOTES AND NOTICES.

Currents in Water.—In the last number of *Silliman's Journal*, in an article on "currents in water," it is asserted, that if a tub or other vessel is filled with water, and a hole made near the middle of the bottom of it to discharge it, the water will acquire a rotatory motion from west to south, or opposed to the apparent motion of the sun; and if means are used to produce an opposite motion, upon withdrawing those means the former direction will be resumed. This cannot be the effect of chance, but of natural laws constantly operating.—*Guernsey Star.*

Household Manufacture of Sugar.—A remarkable proof of the facility with which beet-root sugar manufactories may be established is presented at this moment at Wallers, in the department du Nord. Four of the villagers, by advancing 50 francs each, have formed a joint capital of 200 francs, and with this they produced between 40 and 50 lbs. of sugar, of rather inferior quality, a-day. They employ curry-combs to rasp the beet-roots, which they put into a napkin-press to extract the juice, and then boil the syrup in common culinary boilers.—*Ibid.*

New Ships' Signal Lantern.—A most admirable invention has recently been brought into use, and is likely to meet with general adoption, intended to prevent those accidents which are the cause of so much loss of property, as well as the annual sacrifice of a number of valuable lives. It consists of a ship's lantern, of copper, strongly and efficiently constructed, and possessing the means of being regulated so as to show a light of different colour, according to the tack upon which the vessel bearing it may be sailing, or the position in which she lies. A set of instructions accompanies each lantern, by which the master is informed what light he is to show on each change of tack and position, and thus a mutual understanding is attained amongst navigators as to the meaning of the signals exhibited. The changes of colours are effected by the following simple contrivance:—The lantern contains an interior case, capable of being turned round, and having windows of glass of several colours. The lamp of the lantern has a strong reflector and powerful "bull's eye," or magnifier, to project the light, opposite which, in the outer case, is an aperture. By turning round the interior case, each coloured glass window is brought in front of the bull's eye, and thus a light of the colour required is projected.—*Hull Packet.*

Kemp's Submarine Apparatus.—We understand another attempt is about to be made to raise the hull of the *Cameleon*, by Mr. Kemp, who, having obtained a patent for the invention of his buoying principle, has received permission from Government to make an experiment on this ill-fated vessel, and in the event of its proving successful, the wreck as it may be raised will become the reward of the enterprise. Mr. Kemp's apparatus consists of a number of empty puncheons, each open at one end, and having a bar of iron across, by which, after being sunk, they are attached to a chain, previously passed round the wreck by the divers, who next employ themselves successively applying to each cask the elastic tube through which they are filled by the air-pump, and the water consequently expelled. The puncheons thus charged with air acquire a perpendicular position, and are so buoyant as to render certain the raising of any weight proportionate to the number of them employed. The operation of filling the puncheons with air will be comparatively easy in this instance, as from the favourable circumstance of the wreck lying in less than thirteen fathoms of water, little more than two atmospheres will be required, and scarcely any doubts are entertained of the attempt proving successful.—*Dover Telegraph.*

Massie and Ranwell's Paddle-Wheels.—A few days ago, the first public trial of this new paddle-wheel for steam-vessels was made on the River. It was affixed to the Red Rover steamer, belonging to the Herne Bay Company, which conveyed the female emigrants and agricultural families to the ship at Gravesend in which they embarked for Van Dieman's Land. After the emigrants had left the steam-vessel, to the starboard side of which the new wheel was affixed, the larboard side being furnished with the common wheel, the Emigration Committee, visiters, and several naval officers, proceeded to inspect the new paddle-wheel, a model of which was submitted and familiarly explained by Mr. Massie and Mr. Ranwell. The principle seems to consist in the exposure of the entire surface of the float to the water while in the most advantageous position for propelling, which upon approaching the surface becomes divided into a series of angular bars, which suffer the water to pass through the interstices, and thus transfer the action of the steam-power to the next floats in succession, instead of uselessly wasting it on the water-lift. A considerable ferment in the water (though the swell was not so heavy) was apparent, which, however, a little alteration in the construction will considerably diminish, and which the experiment will enable the inventors to accomplish.—*Weekly Dispatch.*

Coins in the Clouds!—A Brighton physician lately adopted the following singular means of preserving some of the coins of the realm. He enclosed several of the last impression in a ball of wax, which he placed in a balloon of India-rubber sufficiently inflated with gas to raise it several thousand feet above the earth, where, floating in space the memory of our nation and its monarch, may be recorded for hundreds of thousands of years. Within the ball of wax was also placed a slip of parchment with the following letters cut out:—"Anglia Martis X., 1836."—*Dispatch.*

Mr. W. J. Curtis—Received and intended for early insertion.

H. M. M. shall have a place soon—no charge.

Communications received from Mr. Deakin—Mr. Simms—Mr. Peacock—R.—W. B—Mr. Merritt—Mr. Millichap—Americanus—Mr. Mackintosh—F. N. O.—K. K.—A Railway Traveller.

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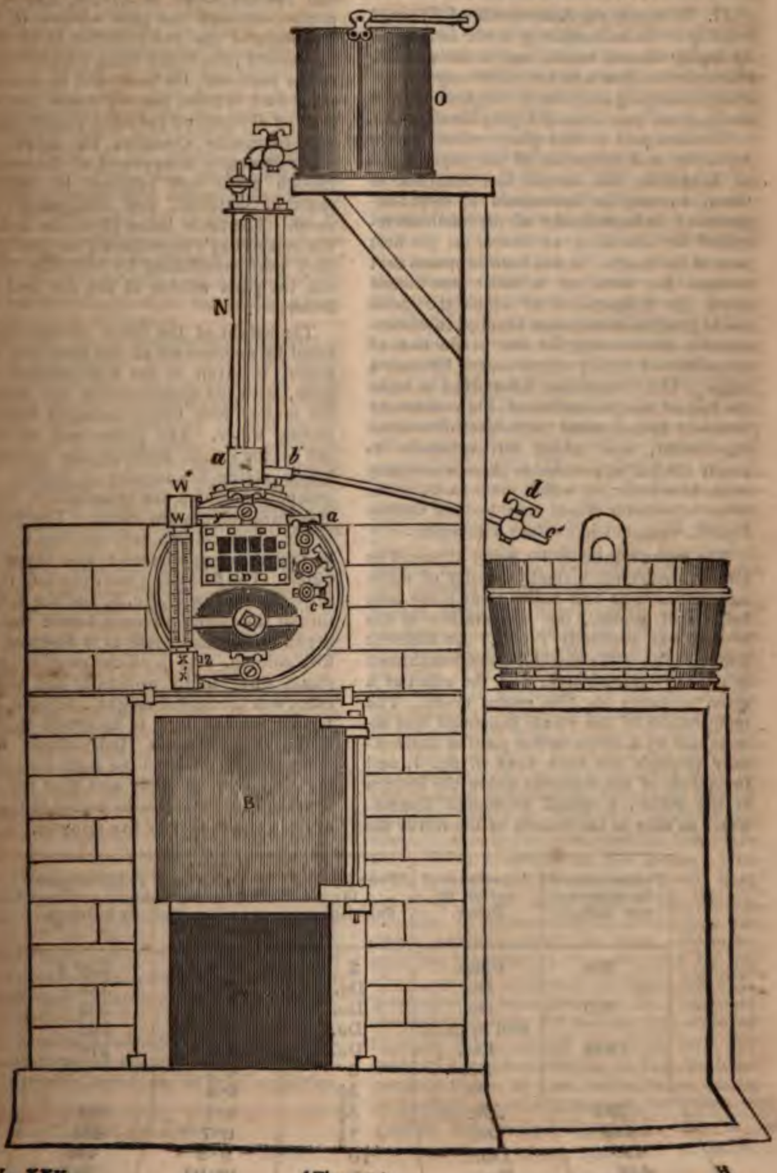
AMERICAN EXPERIMENTS ON STEAM-BOILER EXPLOSIONS.



 (Fig. 2.)

REPORT OF EXPERIMENTS MADE BY THE COMMITTEE OF THE FRANKLIN INSTITUTE OF PENNSYLVANIA ON THE EXPLOSIONS OF STEAM-BOILERS, AT THE REQUEST OF THE TREASURY DEPARTMENT OF THE UNITED STATES.

(From the *Journal of the Franklin Institute.*)

(Continued from p. 92.)

II. To repeat the experiments of Klaproth relating to the conversion of water into steam, by highly heated metal, and to make others calculated to show whether, under any circumstances, intensely heated metal can produce, suddenly, great quantities of highly elastic steam.

The first part of this query relates to the repetition and extension of the experiments of Klaproth; the second has reference to them, but may be determined by direct experiment, independently of the methods required for obtaining an answer to the first part of the query. It has been supposed that because the metal of a boiler was heated above the temperature at which the metal would produce steam most rapidly, it was impossible to account for the production of quantities of highly elastic steam by such a cause. The Committee, determined to make the fact of the production of high steam by intensely heated metal the subject of a direct experiment, and under circumstances as nearly similar as possible to those which may occur in a boiler, of which some parts, as the sides or interior flues, may become unduly heated, when not in contact with water.

The experimental boiler being arranged as already described, a small quantity of water was placed in it and boiled away; the heat being still applied, the temperature of the bottom was gradually raised. At different temperatures of the bottom, water was thrown in by the forcing-pump, and the effect of a given quantity on the gauge noted. The temperature of the steam generated was ascertained by a thermometer passing horizontally through the back head *g*, fig. 1, and two-thirds of the diameter above the bottom of the boiler: a second horizontal thermometer as near to the bottom as the rim of the boiler would permit, served to show whether the heat was rising or falling, and was noted for this purpose. Both the windows of the boiler had glass three-eighths of an inch thick in them, without the cross-bar covering. The water injected was at 70° Fahr. The course of the water injected could be distinctly marked after the bottom of the boiler had become heated to redness, and was examined through the glass window *d*, fig. 3. The force of the pump carried it to the fire end nearly; the boiler being slightly inclined to the back end, the water slid back in one or more dark masses, moving down the central line, or diverted up the sides, greatly agitated and frequently changing its shape. The water generally disappeared at the back end, though parts were retained by accidental spots of sediment, and disappeared upon them. The table below gives the results of the second day's experiments on this subject; they were terminated by violently bursting out the glass window at the fire end of the boiler.

The height of the lower thermometer, as noted by an observer at the back end of the boiler, is given in the first column of the table, with the appearance of the bottom of the boiler, both being examined before injecting water. The gauge was allowed to fall to the height denoting one atmosphere, before giving the number of strokes of the pump, from which the quantities of water in the third column are taken. The pressures in the fourth column were noted on the gauge by the same experimenter who threw in the water. The first effect was examined through the back window D, fig. 3, and the temperature of the steam produced, before the gauge began to fall, was noted as is recorded in the fifth column. As in all the experiments, the steam was rapidly produced, and the total effect was the object sought, the time was no further noticed than to ascertain that accidental circumstances, independent of the temperature, rendered the total time of evaporation very variable, and that the maximum of effect was always passed in the space of from one to four or five minutes.

Temperature of thermometer near bottom.	Appearance of bottom of Boiler.	Water injected in fluid ounces.	Pressure produced by injection. Atmospheres.	Temperature of Steam produced by injection.
306	Black.	2	3·3	336° F.
	Do.	Do.	3·4	340
330	Do.	Do.	3·3	356
	Red in part.	Do.	3·7	362
348	Red.	Do.	3·7	376
	Do.	3	4·2	
	Do.	$5\frac{1}{2}$	8·2	
384	Do.	$5\frac{1}{2}$	8·2	388
418	Do.	$7\frac{1}{2}$	8·7	424
428	Do.	10	9·8	448
448	Do.	Do.	12·0?	516

In the last experiment, the glass window at the fire end of the boiler blew out with a quick, sharp report, as loud as that of a musket; the fragments of glass, from a hole in the centre of the plate, were projected through a window, about three feet from the boiler, and could not be found. The number for twelve atmospheres is placed opposite to this experiment, as being an approximate result. In the act of observing the gauge, the glass burst, and the mercury at once fell: the number of inches at which the mercury had certainly risen, and above which it was, by an undetermined quantity, not however very considerable, was noted; and from this the pressure given in the table is calculated. Here explosive steam was generated by the injection of water upon red-hot iron, and in a time not exceeding one or two minutes at the most, the interval between the last stroke of the pump and the explosion not having been sufficient to note the height of the gauge; the experimenter being at the pump, which was adjacent to the gauge.

By comparing the temperature of the steam in these experiments, with its observed pressure, it will be seen, that in not one of them was water enough injected to give the steam a density even approaching to that corresponding to its temperature: for example, 336° Fahr., should give a pressure of nearly $7\frac{1}{4}$ atmospheres, instead of 3·3, the observed pressure; 388° should give more than 14* atmospheres, instead of 8·2 and 448°; about $27\frac{1}{2}$ atmospheres, instead of 10. The violence of the effect was not, therefore, carried as far as it might have been, the metal not having been cooled down as far as it might have been, to produce the greatest effect; and yet within two minutes the pressure was changed from 1 to 12 atmospheres.

The rise of temperature shown in the first column serves to prove, that by successive introductions of water the metal was not so far deprived of heat as to be cooled towards the point of maximum vaporisation, but that the results were obtained with metal heated to redness.

A similar experiment to these was made by our countryman, Perkins, but surcharged steam being present in the vessel into which heated water was forced, it was to the action of this that he attributed his result. This opinion will be examined subsequently, but the attributed source of action was present only in a very attenuated state, if at all, at the beginning of each experiment made by the Committee.

The repetition and extension of the experiments of Klaproth was one of the most laborious of the undertakings of the Committee, and the results will be found in a future article of the Report.

III. *To ascertain whether intensely heated and unsaturated steam can, by the projection of water into it, produce highly elastic vapour.*

The supposition that water, thrown into hot and unsaturated steam, is flashed into highly elastic vapour, forms the basis of the theory of the explosion of steam-boilers of our countryman, Perkins; a theory which has been embraced by many; and which, though shown to be contrary to the deductions from the well-established laws of heat, is not now without its advocates. It seemed to the Committee interesting to appeal to direct experiment upon this point, and thus to ascertain whether any circumstances, not embraced in the general view of the theory, existed; or whether all the circumstances had been rightly estimated, and the conclusions drawn from the application of the general laws of heat would be confirmed. Being unwilling to incur any considerable expenditure in this branch of their inquiry, the experiments were rendered uncomfortable beyond any thing which occurred in their other researches. The means of producing the unsaturated steam were these: a row of bricks was removed from the top of the furnace, and near to the boiler, thus laying bare nearly half the convex surface of the latter (five inches from the top). By building on the sides of the top of the furnace, with bricks, loosely arranged, a space was formed for placing fuel having the boiler for its bottom, and bounded by the bricks on its sides. A cap of sheet-iron above served to promote the draught, and to carry off much of the deleterious gas produced by the charcoal used as fuel. The fusible plate apparatus was removed from the boiler, to prevent injury, and the safety-valve was surrounded by a tin to keep the fuel from contact with the valve. By filling the boiler about half full of water, and applying heat below to raise the water to any required temperature, the upper half of the boiler would be filled with steam of an elasticity due to that temperature, this elasticity being measured by the gauge. Fire being now placed upon the top, would heat the metal of the upper half of the boiler; and this, by communicating its heat to the steam, would surcharge the latter. To measure the temperature thus acquired by the steam, as well as that of the water below it, thermometers were placed in the iron tubes already described; the mercury was removed from the tubes, except enough to cover the bulbs of the thermometers, so that the temperature shown by them might be, as nearly as possible, that of the steam by which the shorter tube was surrounded, and of the

* Arago and Dulong.

water into which the longer tube dipped. The scales of these instruments were protected from the fire by surrounding them, at some distance, by tin plates. The scales were of seasoned box-wood, the refinement of a correction for the errors of the instruments was not considered to be at all required by the nature of the research, the results of which errors even a few degrees of temperature would not materially affect. In the final experiments on this subject, the thermometers, with metallic scales, and surrounded by water, were put in place. The apparatus for injecting water consisted of a tube attached to the stop-cock *v*, fig. 1, on the back head of the boiler, and which communicated with the forcing-pump; the tube terminated in a spherical segment, in which fourteen holes, each of the size of a cambric needle, were made; through these the water was forced in spray. By examination it appeared that the small stream, from the highest hole, struck the top of the boiler near the safety-valve; that two or three struck the front head; two or three the water in the boiler, near the back head, leaving from seven to nine apertures, the water from which crossed the steam-chamber in an inclined and very effective direction. The effect of the streams from the three or four apertures first spoken of, would be, if they were not taken up by the steam, to vitiate, in degree, the experiments, by striking the top and end of the boiler. With the openings, thus described, the first day's experiments on this subject were made. The heat of the surcharged steam could not, with the arrangements then provided, be raised above 484°. The method of experimenting having been the same as was subsequently used, may as well be stated in this place. The fire having been applied below the boiler, the water was heated to a temperature corresponding to from one and a half to two and a half atmospheres; the coals were then, in part, removed to the top of the boiler, fresh fuel being supplied below: the effect of the heat applied above was soon visible upon the thermometer in the steam, and upon the gauge. When the temperature of the surcharged steam sufficiently surpassed that of the water, as shown by the larger thermometer, the injection of water was commenced, the injection-pipe being carefully kept cool by wet sponges and cloths. The temperature of the thermometers in the water and steam were noticed both before and after the injection by one experimenter, while a second made the requisite number of strokes of the forcing-pump, observed the indications of the steam-gauge, and when the experiment was concluded, gave the quantity of water used. The temperature of the air in the gauge was noted from time to time. The apertures in both the heads were secured with metallic plates, to prevent leakage through them.

On the second day, six of the fourteen small holes were plugged up, that the source of error, already mentioned, might not exist. The temperature attained by the surcharged steam was 440°, at, and below which, experiments were made. The general nature of the results, obtained on the first and second days, coincide, allowing for the difference of circumstances, so entirely with those of the final trial, when a satisfactory temperature was obtained in the surcharged steam, that it would be uninteresting to detail them. The same remark may be made of subsequent trials.

As the quantity of water thrown in during all these experiments was small, it was considered advisable to increase it, in order that more marked effects might be obtained; this was done by removing the pierced head from the pipe, thus delivering nearly the full capacity of the pump at each stroke. The quantity of water thus injected through the steam by each stroke of the pump was, at a mean, half a fluid ounce. No heating of the injection-water was required, as the heat necessary to raise water from the temperature of the experiments to the boiling point was but a small fraction of that required to convert it into steam.

In the last day of trial the heat of the top of the boiler was so great and so long sustained, that the thermometer in the water became, in the course of the experiments, for reasons which will be stated, comparatively useless, as an indicator of the temperature of the water. The following tabular view of the results of the experiments is extracted from the minutes. The first column of the table contains the temperature of the surcharged steam, previous to the injection of water in any experiment; the second column that after the injection: this comparison being made to ascertain whether the heat supplied was, or was not, sufficient to make up for that consumed in vaporising the water thrown in. The third column shows the quantity of water injected; the fourth the height of the gauge before the experiment; the fifth the height after the experiment; the sixth the temperature of the gauge; the seventh and eighth, the pressures in atmospheres, calculated from the height of the gauge, and the temperature of the air within it, before and after each experiment. No notice is taken of the temperature of the scales of the thermometers, it having varied but 10° Fah. namely, from 86 to 96°.

The first experiment is introduced, to show the temperature of the water within the boiler, before the long-continued heat had sensibly affected the indications of the thermometer.

Height of Thermometer in Steam.		Ounces of water injected.	Height of Gauge in inches.		Temperature of air.	Height of Gauge in Atmospheres.		REMARKS.
Before experiment.	After experiment.		Before experiment.	After experiment.		Before experiment.	After experiment.	
376		0	21·17		65	5·72		For comparison, no water injected. Water in the boiler, 318° Fah.
462	463	2	21·30	21·25	66	5·85	5·80	
506	509	3	21·50	21·50		6·15	6·15	Gauge stationary.
508	510	7	21·52	21·47		6·21	6·07	
518		0	21·80		70	6·65		Temperature of air in gauge noted between two experiments.
519	521	3	21·80			6·65		Gauge fell slightly, then rose to original level.
522	524	6½	21·80	21·70		6·65	6·48	
526		10	21·80	21·65		6·65	6·41	
528	528	13	21·80	21·60		6·65	6·34	
532		0	21·90			6·82		
533	533	6	21·90	21·85		6·82	6·74	Rose again immediately to 21·90.
533	533	14	21·90	21 70		6·82	6·48	Fell nearly ·2 inch. *Note.* 533° is, according to the formula of Arago and Dulong, the temperature of saturated steam of more than *sixty atmospheres.*

At the close of these experiments, the metal was, in many places, but little short of a red heat, visible in day-light.

The precise state of things in a boiler, of which parts are unduly heated, was represented in these experiments; there was the surcharged steam, and heated metal ready to give up its heat to replace what might be absorbed in the conversion of the water injected into steam. This latter circumstance renders the case different from that contemplated in the deductions of theory which have been brought to bear upon the question. The greater or less intensity of the heat afforded by the top and sides of the boiler would necessarily modify the effects observed, by the injection of any given quantity of water; this is observable in the numbers given in the table, where although the greater quantity of water injected does not fail in two consecutive experiments to show a greater depression of the gauge, yet in distant experiments the same is not the case. *We see that in no case was an increase of elasticity produced by injecting water into hot and unsaturated steam, but the reverse, and in general that the greater the quantity of water thus introduced, the more considerable was the diminution in the elasticity of the steam.* The quantity of water injected was from 3·5 to 24·3 cubic inches. The immediate rise of the gauge after each experiment, shows how rapidly heat was supplied by the sides of the boiler to the steam within.

That the steam was highly surcharged with heat, appears by comparing the pressures *corresponding to th e*temperatures with those given by Dulong and Arago for saturated steam. For example, the pressure shown by the gauge when the steam was at 506° Fah. was 6·15 atmospheres, while the table just referred to gives for this temperature a pressure of *forty-eight atmospheres.* The temperature was carried to 533° Fah. when the pressure shown by the gauge was 6·82 atmospheres, while saturated steam at that temperature would have had a pressure of more than *sixty atmospheres.*

In order to ascertain whether the thermometer relied upon to give the temperature of the steam was affected, if at all, in excess or defect by the conducting power of the metal; the temperature of the boiler just beyond the tubes was taken, as nearly as was practicable, by a thermometer R, fig. 1, dipping into a clay receptacle, upon the top of the boiler. This thermometer did not rise above 405° Fah.; its distance from this source of heat was ten inches, and that of the iron tube inclosing the thermometer, six and a half inches. Supposing the temperature stationary on top, the temperature of the metal of the top of the boiler near the tube of the thermometer would have been 479°,* show-

* If we suppose the heat of a small bar of metal, cut from the top of the boiler, to have been derived by the conducting power of the metal alone, the heating effect of the steam within being neglected, and further, that the temperatures of the bar had become constant, then the ratio of the excess of the temperature (y) of any point at a distance (x) above the temperature of the air, to that (y') of any point at a distance (x'), is given by the proportion,

$$y' : y :: \log. x : \log. x'.$$

In the case before us, $y = 405 - 80 = 325°$, $x =$

ing that it tended to carry off heat from the thermometer, which, if at all affected by the metal above it, showed too low a temperature for the steam in contact with it. The temperature of the source of heat would have been from these data, 582° at the extreme end of the part covered with fuel, which was of course at a lower temperature than the middle portion.

On examining the apparatus after the conclusion of the last day's experiments, it was found that some of the putty used in tightening the lower joint of the thermometer in the water had been softened by the heat, and had flowed into the tube, thus affording a direct communication between the steam and the bulb of this thermometer: this circumstance accounts for the instrument being affected in this day's experiments and not in the preceding ones.

IV. The next query may be thus stated: *when steam, surcharged with heat, is produced within a boiler by the contact with heated metal, does this steam remain surcharged, or does it take up water from contact with that in the boiler, and become saturated steam?* If the latter supposition be correct, at what pressure and temperature with regard to the temperature of the surcharged steam, and to that of the water on which it rests?

The answer to this question is given by the experiments just detailed; and as they established the negative in relation to the surcharged steam becoming saturated, there was no necessity for a repetition of the experiments to ascertain the precise temperature of the water in the boiler. When fire was applied to the top of the boiler, the water within was at 318° Fah.; a moderate fire was kept up below, and one so nearly uniform, that great variations from that temperature could not have taken place, and which the results satisfactorily show did not occur. If we assume that during the experiments the temperature was 308½° Fah., a remarkable correspondence will be found in the observed pressures, and in those calculated on the supposition that this steam was expanded by heat, as a gas would have been, without any addition of water. The table below gives the temperatures of the surcharged steam observed at different times during the course of the experiments; the pressure shown by the gauge at that temperature; the pressure which would have been produced by heating steam at 308½° to the temperatures given in the first column by the mere effect of expansion; and the pressures of saturated steam at the different temperatures.

Temperatures of surcharged Steam.	Corresponding pressures from experiment.	Pressures calculated from expansion of Steam, 308½° by heat.	Pressures of saturated Steam at the different temperatures.
308½		5·2	
376	5·7	5·6	10·4*
462	5·8	6·2	31·6
506	6·1	6·5	48·0
526	6·6	6 7	57·3
533	6 8	6·75	61·1

A comparison of the second and third columns shows that in these experiments, which lasted more than two hours, the surcharged steam remained in contact with water without

10·0 inches, and $x' = 6·5$ inches, whence $y' = 399°$, and the temperature at that point is $y' + 80 = 479°$.

To find the temperature of the source of heat, we have the equations—

$$y' = A\,e^{-x'\sqrt{\frac{2h}{kl}}} \quad \text{and } y = A\,e^{-x\sqrt{\frac{2h}{kl}}}$$

in which y' and y are the excesses of the temperatures at the distances x' and x over that of the air. A is the temperature of the source, e the base of the Naperian logarithms, $2l$ the thickness of the bar, and $\frac{h}{k}$ the ratio of its radiating to its conducting power. To find $\sqrt{\frac{2h}{kl}}$, which is the same for the two points x and x'; we have

$$\frac{y'}{e^{-x'\sqrt{\frac{2h}{kl}}}} = \frac{y}{e^{-x\sqrt{\frac{2h}{kl}}}},$$ whence Nap. log. y' $+ x'\sqrt{\frac{2h}{kl}} =$ Nap. log. $y + x\sqrt{\frac{2h}{kl}}$, and

$$\sqrt{\frac{2h}{kl}} = \frac{\text{Nap. log. } y' - \text{Nap. log. } y}{x - x'}$$ in the case before us, $\sqrt{\frac{2h}{kl}} = ·058$ and log. $A =$ log. $y' + x'\sqrt{\frac{2h}{kl}}$, log. $e = 2·765$, and therefore $A = 582°$.

The boiler must have been hotter at the furthest point than it would have been if not in contact with the surcharged steam.

* These numbers are obtained from the table of Arago and Dulong, by interpolating between the terms; and though not rigidly correct, are abundantly so for this purpose; the last two numbers are obtained, by substitution, in the formula given by these experimenters, as resulting from their observations.

acquiring from it the water necessary to convert it into saturated steam, but retaining its surcharged state. There is nothing to warrant the belief that any of the surcharged steam was condensed by the water.

V.—Inquiry in relation to Plates of Fusible Alloys.

It is well known that one of the most scientific nations of Europe relies, particularly, as a means of safety for steam boilers, on the use of plates of fusible metal. The plates are alloys of tin and lead, or of these two metals with bismuth, the proportions of the component metals regulating the point at which they fuse. In France these alloys are prepared at the royal mint, where plates made from them, or ingots of the alloys, may be purchased for use. The examinations which must have been made to determine the proportions of the metals necessary to produce an alloy fusing at a given temperature, and the circumstances of fusion, have not, as far as the committee know, been made public. A table of the fusing points of different alloys of tin, lead, and bismuth, &c., was drawn up by Parke, from experiment, and is contained in his chemical essays, vol. ii. p. 615. This table was made the basis of the investigations* undertaken by the committee, but they soon found it convenient to depart, more or less, entirely from it.

The method employed by Parke for determining the fusing point of a metal, or rather the solidifying point of the melted metal, was ingenious. On melting a metal, and allowing it to slowly cool to the point of congelation, and observing a thermometer plunged in it, a rise of temperature, and then a stationary point, is observed; this is a point where a change is going on, by which the heat given out in the change is equal to that of which the metal is robbed by the surrounding medium. This point usually coincides with the passage of the metal to the solid state, from what may be either the liquid state, or a semi-fluid state, similar in aggregation to sand; sometimes the alloy is solid throughout, before the stationary point arrives; and sometimes there is more than one such point.

The stationary point is not that at which the alloy, when used as a fusible plate for a boiler, gives way; the plate being covered by a perforated brass disk, to prevent its being pressed outwards before fusion, and so reduced in thickness as to burst, the metal is not forced out through these openings until perfectly fluid; if any part of the metal becomes fluid before the rest, and gives way, the rest being in the sandy state, just spoken of, the particles seem to act like those of sand in a similar case, and to oppose an effective resistance to the pressure of the steam; these facts will be further developed in the examination of the application of these plates.

The stationary points, when taken with due reference to the state of the metal at the time, afford so many approximate marks by which to compare together the fusibilities of the plates, and to ascertain whether they bear a due relation to each other, when fused, in place upon the boiler; and to study the alloys themselves. In composing alloys of the metals, before referred to, the tin was fused first at as low a temperature as possible, then the bismuth and lead added, the heat being kept up; these metals were readily taken up by the liquid tin, and were thus little exposed to oxidation: the surface of the alloy was always protected by a stratum of oil. The metal was constantly stirred to promote the uniform diffusion of the different metals throughout each other.

The alloy being liquid, a thermometer, of which the errors had been carefully ascertained, was plunged into it, and the fall noted until it reached the lowest point; the rise to the stationary point followed, and at this the thermometer usually remained for such a length of time, often some minutes, as to render any error of observation unnecessary. Some of the alloys have no stationary point, properly so called, and the beats of a second's pendulum were used to determine the rate of their loss of heat. When the quantities of metal used were inconsiderable, the heat was observed to be carried off so rapidly as to lower, or entirely to destroy, the stationary point: to avoid this, the crucible containing the alloy was placed in a second one, the edges of the former resting on the middle of the sides of the latter. The quantity of metal used was never less than between five and six ounces, troy.

The stationary point being at the passage of the liquid metal to the solid state, or at some interior change of the solid itself, the thermometer was entangled in the metal; and in moving the alloy, to re-melt it, the instrument was endangered.* This was remedied by the use of a small cylinder of very thin sheet-iron, containing mercury. This cylinder was placed in the alloy, and filled up to the surface of the metal with mercury, and the thermometer could now be readily placed

* At the time these experiments were made, the paper of Rudberg Ann. de Chimie. et de Phys., vol. 48, had *not appeared.*

* Although the instrument was frequently used in determining the stationary points, no permanent changes in the indications of the instrument, such as was noticed by M. Rudberg, took place.

and removed. Care was taken to ascertain that the stationary point, given in the cylinder, was the same with that shown by the naked thermometer. As some of the alloys expanded considerably on congealing, it was supposed that the cylinder might prevent error from the compression of the bulb of the thermometer, but no such compression in the instrument used was detected by frequent trials.

As the alloys were intended for ordinary use, it was deemed advisable to ascertain how far the impurities of the metals, as they occur in commerce, would cause a variation in the fusing point. Tin has a very uniform purity in commerce, the grain or stream tin being always accessible. The bismuth of commerce being obtained principally from the native bismuth, is probably not very variable.* The lead contains variable quantities of silver, copper, and iron. The first experiments were made on the fusing point, on various specimens of common tin: this tin showed, by re-agents, a trace of iron and of copper, as impurities. The fusing point of grain tin is 442° Fah.

COMMON TIN.	Stationary Point.	REMARKS.
Specimen, No. 1.		
First experiment,	441·75°	Thermometer in cylinder.
Second do.	442·25	do. do.
Third do.	441·75	Without cylinder. Stirred.
Fourth do.	442·00	do. do.
Mean,	441·94	
Specimen, No. 2.		
First experiment,	441·50	In cylinder.
Second do.	442·00	do.
Mean,	441·75	
Specimen, No. 3		
First experiment,	438	In cylinder.
Second do.	439	do.
Mean,	438·5	
Specimen, No. 4.		
First experiment,	441	Thermometer in cylinder.
Second do.	443	do. do.
Third do.	441½	Without cylinder. Stirred.
Fourth do.	443	do. do.
Mean,	442·12	
Specimen, No. 5.		
Single experiment,	442	In cylinder.

The fusing points of the different specimens varied slightly, but the differences, in a practical point of view, are nothing.

The fusing points, in the case of tin, coincide nearly with the stationary points, the metal passing rapidly from the liquid to the solid state. When the change of state is rendered more rapid by agitation, the stationary point is slightly raised; the heat, which is produced in the change, not having time to be carried off, as when the change is allowed to proceed by degrees.

* It is proper to state, however, that some specimens were procured, obviously obtained from the sulphuret, and contaminated with it. They were not used.

Lead from the Paris mint, of the kind used for cupellations, and containing a very minute quantity of silver, as an impurity, was next compared with the common lead used by plumbers. The experiments were as follows:—

Pure Lead.	Stationary Point.	Common Lead.	Stationary Point.
First experiment,	601^0	First experiment,	604^0
Second do.	601	Second do.	604
Third do.	602		
Fourth do.	602		
Mean,	601·5	Mean,	604

An attempt was next made to ascertain what effect the impurities shown by the fusing point of lead would have upon the fusing points of alloys, into which it entered. Alloys, in atomic proportions, were selected, as much was expected from them in the way of avoiding the slow passage from the liquid to the solid state, which was observed to be the property of certain mixtures of the metals. Alloys of tin and lead were therefore made in atomic proportions; first, of grain tin and the lead already spoken of, from the Paris mint; the second, of block tin and common lead. The tin was employed in multiple proportions, as being the more fusible metal, it would probably enter more largely than the other, into the composition of fusible plates for steam-boilers. The equivalent of lead is 104; of tin, 58; the first alloy was composed of the two metals, united in this proportion, the total weight of the components being about ten ounces, troy; a new equivalent of tin was next added, and so on, through the series: the results are given in the following table.

Upon this table we remark, first, that at all the stationary points, except in the alloy of 1 lead to 2 tin, the metal was solid at the stationary point; second, that although the proportion of tin varied from one to six, and even to seven, the stationary point was not changed more than $3\frac{1}{2}^{\circ}$ for the first series, and $5\frac{1}{4}^{\circ}$ for the second; third, that in the proportion of one of lead to four of tin, a second stationary point appeared at the point at which the metal began to lose its entire fluidity, and was found in the higher parts of the series, rising with the increased proportion of the more fusible metal, with difficulty detected at times, and disappearing by agitation of the alloy; fourth, that the tin and lead of commerce give, for the lower stationary points in the same alloys, quantities nearly the same. A comparison of the upper stationary points appears on next page.

Equivalents of: Pure Lead.	Equivalents of: Grain Tin.	Stationary point.	Number of Observations of which the stationary point is the mean.	REMARKS.
1	1	$354\frac{1}{4}$	2	Begins to lose fluidity at 430^0, soft solid at 410^0, do. 400^0, still yields to a stick at $350\frac{1}{2}^0$, rises to $354\frac{3}{4}$, the stationary point, hard and unyielding.
1	2	$357\frac{3}{4}$	2	Thermometer fell to $356\frac{1}{2}^0$, metal still liquid, congeals very irregularly, rises to stationary point, parts of the metal still fluid.
1	3	$357\frac{1}{2}$	1	
1	4	$358\frac{3}{4}$	2	Thermometer fell to 365^0, rose rapidly to 369^0, where it was stationary for a short time, then fell to $357\frac{1}{2}$, where it was stationary for some minutes.
1	5	$357\frac{3}{4}$	5	Thermometer was 30 secs. in falling from $369\frac{1}{2}^0$ to $362\frac{1}{2}$, very slow: stationary at $357\frac{3}{4}$ for 100 secs. No other stationary point to 200^0.
1	6	$358\frac{1}{4}$	4	Thermometer stationary at 377^0, in one experiment, then fell to 358°, stationary 35 secs.: at 377 soft solid, easily penetrated, hard at lower stationary point. In another expt. fell to 377°, then rose to 379^0, whence it fell rapidly to $358\frac{3}{4}^0$, the lower stationary point.

struck with the coincidence upon reading the above extract, and thought it worth recording. There may possibly be some great law of nature peeping forth through this small aperture, and which, if the opening could be dilated by a few additional facts, might instantly emerge into broad day.

Yours, &c.

TREVOR.

MR. JOPLING'S RAILWAY HINTS—RAILWAY-CARRIAGE BREAK.

Sir,—With due deference to Mr. Jopling, I beg to state, that the idea of applying bands or straps to locomotive-carriages, however new or novel, on railways, is not so as regards steam-carriages on common roads, a patent having been taken out by an eminent engineer some few years ago for the purpose; I believe, however, it was never brought into practice. The smooth and equable motion of the carriages on railways is certainly a powerful argument in favour of its adoption; as is also the introduction of the method used by Mr. Russell in his road steam-carriages; namely, dispensing with the crank-axle, and substituting either cog-wheels or wheel and pinion, thus gaining either power or speed; also taking the action of the engine off the propelling-wheels in an instant. A sort of basket, to precede a train of carriages to turn any impediment off the railway, was proposed in the *Mech. Mag.* No. 404, by Sir G. Cayley some years ago.

Since the opening of the Greenwich Railway, I beg to state, that I have contemplated an addition to the locomotive-carriage, in the shape of a break,* applied either to the propelling-wheels, or to the whole four. The method is easy of adoption, and the mere act of shutting off the steam will bring the apparatus into play. As I cannot, however, just now spare time to make the illustrative drawings, or complete an experimental model, I must, for the present, withhold further communication on the subject, and am,

Sir, your obedient servant,

J. ELLIOTT, Machinist.

14, Stacey-street, Soho.

* We have been favoured with a description of the break now in use on this railway by the inventor, and shall give it in our next or succeeding Number. It is a very excellent one.—ED. M. M.

THE LONG-WORK SYSTEM OF MINING.

Sir,—I am greatly obliged to you for the information you gave me in your excellent Magazine (vol. xxiv. p. 505), with regard to the mining of coal by the long-work system. You inform us that the Committee came to the conclusion that the present mode of working in the North was better than long-work, and yet Mr. Buddle does not deny that long-work is the best mode of ventilating a mine; and Mr. Mitcheson says, the current of air passing through long-work would keep it clear, and so prove an advantage.

Now, sir, what did the Committee meet and hear evidence for—was it not to get at the best mode of ventilating the coal-mines in the North of England, and, consequently, the saving of human life? Did not the evidence prove to them that long-work was the safest way to work the coal, and to subdue the gas, in the North of England collieries? 'Oh, but then we have tried this and the other method, and we like our own best; it is what we have been used to from our youth. And as to the loss of lives, we have been accustomed to that also, therefore we may as well go on as we are.' So, instead of adopting a method that would convey the atmospheric air round the face of the whole working, and to every living soul in the mine, the colliers are still to be employed in holes and corners where no atmospheric air can approach—destruction, ready upon every change of wind or density of atmosphere, to be forced out into the open roads and workings. From that moment the mis-called safety-lamp becomes a man-trap.

Mr. Buddle in his evidence says, that he had tried the principle of long-work, generally called the Lancashire system (it is the *Shropshire* system of long-work I am contending for); but that induced a double mischief—too much small coal by the weight of the top behind pressing upon the face of the coal—If Mr. Buddle's long-work had been long enough and wide enough to have brought down the roof of the mine behind him, it would have lightened the pressure on the face of the coal, and instead of breaking the coal small, would have assisted in working it. "But the chief mischief," he says, "attending it, was the breaking of the strata up to the yard coal-seam,

and bringing down double the quantity of gas." If it brought down six times the quantity of gas, a proper well-managed quantity of air continually kept in motion round long-work, would have swept it away. But the yard or Bensham coal should be worked before the next under it.

I should very much like to know how Mr. Buddle's long-work was began; upon what plan it was opened; how wide and long it was when it grinded the coal to powder; whether the roof broke down at all behind him before he gave it up? I say nothing of the mode of working the thick coal in Staffordshire—that is not long-work; one thing only I would observe,—some of the boys employed now on that magnificent vein of coal will be rummaging it over again for what is left behind by their present mode of working it. Mr. Buddle, speaking of the Bensham seam of coal, says, "I found it prodigiously fiery, so much so, that the coal itself afforded gas enough to light the pit. * * * I drilled a hole into the coal, and stuck a tin pipe into it, and lighted it, and I had immediately a gas-light." Now, sir, that proves nothing at all extraordinary, because I have seen much greater intimations of fierceness than that, and the mine as sweet and clean of gas, at the time, as a house. I have seen oftentimes, when the colliers have been making a cutting across the seam about six or seven inches wide and three feet into the solid coal, a lighted candle has been put into the cutting, and the gas would ignite immediately and fill the cutting with flame, which would frequently keep burning till it was brushed out. No one in the mine cared a fig for such incidents as this, because they knew a current of air was passing along the face of the work, which would not suffer the flame to come out of the cutting.

Mr. G. Mitcheson, on being asked if he thought the principle of long-work could be applied to the northern collieries, said, that "in many places in the North they had a post or stone roof that would stand forty or fifty yards upon an area; he did not think that long-work could at all be practised there, for it would never break down behind them, and there would be ten times more space for foul air than there is now."

According to this witness the stone roof will stand forty or fifty yards upon an area, but I should not call that long-work; that is, stall and pillar work. I have seen walls of coal worked 400 or 500 yards in length. Does Mr. Mitcheson think the northern stone roofs would fall in that length behind him? I know they would, though I also know that a rock roof is not the best roof for long-work. The first sinking that takes place in long-work, after a sufficient quantity of coal is taken from under, to allow the strata to settle down, if the roof is very strong, shale or rock, often causes great confusion, and a novice in the trade would be soon inclined to abandon it. But an old long-worker knows how to manage the weight to his own advantage, ever after, in working the mine. Why did not the Committee procure the opinions of some Shropshire long-workers? In that district the system of coal-getting is wholly long-work, whether the roof be stone, clunch clay, or even sand!

I am, your obliged servant,

THOMAS DEAKIN.

Blaenavon, May 5, 1836.

CIRCULATING DECIMALS.

Sir,—Your correspondent, G. C. L., p. 43, is somewhat hasty in his assertion, that I have taken but a partial view of the question I proposed and answered, on circulating decimals.

The rule I gave may be applied generally, though in some cases it requires a knowledge of several properties of circulates, some of which I referred to in my former communication. The example attempted to be worked by G. C. L. may be considered as one case of the rule, and that proposed by me as another, though this is almost a distinction without a difference; for, in his example, the denominator of the decimal is $\frac{1}{0584+}=$ 17, as found by him and the numerator, $\frac{38235+}{05882+}=6\frac{1}{2}$: hence, the fraction is $\frac{6\frac{1}{2}}{17}=\frac{13}{34}$. The attempt to find the denominator by the part next in value, reminds me of the school-boy, who, if he obtain the "answer," heeds not how it has been procured.

In order to avoid complex fractions, if, by the first part of the rule, it is found

that the decimal is a mixed circulate, the given part may be multiplied by that power of 2, the index of which is the number of terminate figures; this product, divided by the part of the least value, will give the numerator and the denominator found by the rule, being multiplied by the same power of 2, will give the required denominator.

It is with regret that I am forced to observe, that your correspondent does not appear to have sufficiently considered the subject; in the second paragraph he says, "if we take any numerator for the fraction $\frac{}{43}$, we shall always find the same figures constantly recur." This is not correct, the circulates of $\frac{a}{43}$ consists of two series, of 21 figures each, hence ·0232, &c. does not recur in every multiple of the same, as may be readily seen by trying it with either 2, 3, 5, 7, 8, 12, 15, &c. the products of which will be a series complementary to ·0232, &c. The same figures can only recur by every multiple when the number of figures in the series is one less than the denominator, as in $\frac{a}{19}, \frac{a}{97}, \frac{a}{499}$.

In the same paragraph he asserts, that "the equivalent of $\frac{1}{34}$ *does not recur* in the multiplication by the numerator." This assertion, if a quibble be raised upon the word equivalent, may be correct; but the circulates of $\frac{a}{34}$ consist of two series, one of which is $\frac{a}{17}$, a pure circulate of the figures, and the other $t\frac{a}{17}$, a mixed circulate of 17 figures, in which t is a terminate number prefixed to $\frac{a}{17}$, the part therefore forming the circulate *does recur* with every multiplier.

Having adopted an original method for exhibiting the circulates of any fraction, which affords a ready means for examining their several properties, I subjoin the circulates of $\frac{a}{34}$ as an example.

34ths.	1	27	15	31	21	23	9	5	33	7	19	3	13	11	25	29
	0	7	4	9	6	6	2	1	9	2	5	0	3	3	7	8
	2	9	4	1	1	7	6	4	7	0	5	8	8	2	3	5

17ths.	1	10	15	14	4	6	9	5	16	7	2	3	13	11	8	12
	0	5	8	3	2	3	5	2	9	4	1	1	7	6	4	7

In these tables the upper lines are the numerators, or successive remainder, in finding the circulate by the common method; and the bottom lines the circulating series. The middle line is the terminate figures; these arise from all fractions whose denominators are divisible by 2, 2^n, 5, 5^n, and they possess the same property as the series, viz. half being complements to 9 with the other half. By the arrangement, the commencing figure of the series is placed under its respective numerator.

When $\frac{a}{m}$ is exhibited in the form of a circulating decimal, a series of figures equal to $m-1$ is either produced, or two or more series, the sum of the figures in which is $m-1$; and this always happens when m is a prime number, or any other number not divisible by 2, 2^n, 5, 5^n. For example: $\frac{a}{7}$ forms one series of 6 figures, $\frac{a}{53}$, four series of 13 figures, $\frac{a}{69}$, three series of 22 figures, and two of 1 figure. When m is divisible by 2 or 5, one added to the number of figures that circulate, completes the amount $m-1$.

All the circulates formed from any denominator m, as above, are multiples of each other; consequently, if in the application of the first part of my rule the series are found to recur without embracing every figure produced by the

multiplication, the fraction $\frac{a}{m}$ will consist of more than one series, each of which must be found either wholly, or in part, to discover where the series is of the least value decimally.

I have not had time to investigate the rules given by G. C. L., which may be correct, though the first one, upon which the others depend, has an inconsistency in its expression; for if ·999, *ad infinitum*, is to be divided by the given number, there cannot be a last remainder: he probably means that the division is to be made until the figures recur; if so, it is fortunate for him that the answer to my question, which he has chosen to illustrate his rule, happened to be $\frac{15}{43}$ = to the reciprocal of $\frac{14}{5}+\frac{2}{30}$, else the division might have extended almost *ad infinitum*.

To your mathematical readers, I would suggest the following subject of investigation—since the numerators, and likewise the series, follow a law of progression, rules remain to be discovered for finding the value of any term, the nature of the ratio, the place of the term, &c. These inquiries, if investigated, would open a most extended field for analytical discovery.

Yours respectfully,
ANTHONY PEACOCK.

April 30, 1836.

MORDAN AND CO.'S NEW PATENT PEN.

Sir,—It is a great pity that patent speculators, before patenting a thing, do not give themselves the trouble to ascertain whether a similar production to it has been, in any shape whatever, previously before the public. The want of this very necessary precaution exhibits itself in the instance of the three-nibbed metallic pen, advertised in different journals, and exhibited (per engraved card) in various stationers' windows, as a recent patent of Messrs. Mordan and Co.

At p. 31 of a pamphlet on metallic pens, by J. Carstairs,* will be found the description of a metal pen, the invention of a Mr. James Gowland, chronometer-maker, 11, Leathersellers' Buildings, London Wall, answering precisely to the subject of the present comment. The hardship of individuals losing their inventions, through an incapability of ascertaining what had been before invented and privately made use of, has been altogether removed by the alterations in the law of patents; the public, however, have a just right to benefit by the oversight of patentees where the opportunity exists of information. It is a matter of surprise that gentlemen so long in the field of invention, and *bona fide* manufacturers into the bargain, as Messrs. Mordan and Co., should have put themselves to the expense of attempting to secure what appears to be nearly, if not quite, a year old.

Sir, your obedient servant,
SCRUTATOR (*pro bono publico*).

* Simpkin, Marshall, and Co. 1835.

HANCOCK'S STEAM-CARRIAGES.

Mr. Hancock still continues to run his steam-carriages on the Paddington-road with uninterrupted success. No accidents have happened, nor any derangement of the machinery, unless the breaking of a chain pulley may be so called, which was immediately replaced by another. The "Infant," which Mr. H. yesterday (Friday) brought from Stratford, for the purpose of working on the Paddington-road, is the *first* steam-carriage that ever ran for hire, which it did on the same road about six years ago, and a *fortnight before* Sir Charles Dance commenced running on the Cheltenham-road with Mr. Gurney's drag. The "Infant" seems in excellent condition, and apparently not any the worse for the occasional working it has had since its birth.

The rate of travelling during this week has been about the same as last; averaging one hour and ten minutes from the City to Paddington and back, a distance of nine miles. Of this time upwards of one-fourth is consumed in stoppages for coke, water, and passengers. From Monday morning, to Thursday 12 o'clock, sixteen single trips to Paddington were performed, and forty-six to Islington. The number of passengers carried was 711.

We understand the carriages will continue to run daily, in the morning from 9 to 12, and in the afternoon from 3 to 6 o'clock.

NOTES AND NOTICES.

Preservation of Animal Substances.—A pamphlet published at Florence gives an account of a strange discovery by Geralamo Legato, the accuracy of which is attested by the principal professors in that city. It appears that Legato, while traversing the deserts of Africa in 1820, for the purpose of perfecting a map, discovered in one of the hollows which a whirlwind had ploughed up, a completely charred human body, the flesh and bones of which were in good preservation. It struck him that the process of charring could only be effected by the scorching sand, and that if the heat of the sand had in this instance effected the complete disiccation and carbonization of animal substances, it might be possible to effect something similar by artificial means. On his return to Italy, he commenced his experiments, and at length succeeded in imparting to the limbs and bodies of animals solidity, and indestructible durability. By this, whole bodies, as well as individual parts, acquire a thoroughly firm consistence, which is more decided according as the respective parts are harder or softer. The skins, muscles, nerves, veins, fat, blood, all undergo this change without its being necessary to remove the intestines, which assume the same consistence. At the same time the colour, form, and character, in general, remain unchanged; no smell is perceptible, and both joints and limbs remain flexible and moveable as when alive. When bodies have acquired this consistency, neither damp air, moths, nor water can effect them. The weight is but slightly diminished. Not a hair is lost; on the contrary, they are rooted more firmly than ever. Birds and fishes lose neither skins, scales, nor colours, and in like manner insects and worms remain perfect in every respect. Legato's cabinet contains many specimens of this novel and singular discovery. One of the most remarkable is a table composed of 214 pieces joined together. The observer would take them for so many different kinds of stone, and yet they are nothing more than portions of the human members.—*Scotsman.*

Colossus Redivivus.—An Englishman has lately erected on the banks of the river Theiss, in Hungary, a mill in the form of a colossal man. The head is the dwelling-house, the eyes serving for windows, and the nose for a double chimney. The machinery is placed in the body, and set in motion by a stream of water from a canal in the form of an immense bottle, which the monster is emptying into his mouth.—*Times.* How is the water raised into the bottle?—Q.

New Percussion Gun.—The Wirtemburg papers occupy themselves much about experiments made with a percussion gun, of the invention of Duke Henry, by means of which an able soldier can fire eight or ten shots in a minute.

Wonders of Mechanism.—The *Hague Journal* states, that a Dutch artilleryman, named Vander Boll, having lost both his arms below the elbow, by an explosion, the sculptor, J. F. Freit, of Flushing, has contrived and executed for him two artificial fore arms and hands, with which he can feed himself, put on his clothes, perform all other ordinary offices, and even write. (?) The poor man was also deprived of one of his eyes, but for this we suppose no substitute can be found!—*Guernsey Star.*

Sampson Twigg and Co., a firm of three labouring men, obtained permission to work in a mine at Botstone, in this county, the property of Messrs. Gaunt and Challinor, of Leek, and to take the minerals, subject to a certain tribute to the proprietors, for six months to come. The mine is at the bottom of a stupendous mountain. The men began at the bottom of the hill, and after considerable labour were able to strike through some coverings of flint, when they discovered a vein of ore, almost pure lead, and in three days have not raised less than three tons, worth 20*l.* a-ton. It is expected, without exaggeration, that for six months to come they will gain 100*l.* a-week by their own manual labour, exclusive of the tribute payable to the proprietors; but fears are entertained that their good fortune may cause the death of some of them from over exertion, as they are not to have any assistance. Botstone is within half a mile of the famed Ecton mine, from which the Duke of Devonshire amassed so large a fortune; and what is very singular, these three men have been working at the first-named mine near one year, earning not more than 12*s.* each a-week, and have frequently blasted within a yard of the place where the treasure has been discovered. The face of the vein is not six yards from the surface.—*Stafford Paper.*

Mr. Thomas Sheriff, Westbarns, East Lothian, has invented a plough, for which he has been awarded a premium of five guineas by the East Lothian Society. The property of this implement is to cultivate the subsoil, in opposition to the system of trenching, which was lately introduced into East Lothian, and the tendency of which was to turn down the rich vegetable mould, and raise up the subsoil, in many, nay, in most cases, always the inferior. Its construction is simple, and every common plough can be converted into a subsoil plough at pleasure, and at a trifling expense. It is only calculated to operate successfully on a subsoil which does not afford much resistance; but a plough has been invented in Stirlingshire, which, with a proper application of strength, will cultivate the most stubborn clay subsoil that exists.—*Farmers' Magazine.*

Communications received from A Subscriber—Mr. R. Roberts—Mr. Lunt.

"An Old Subscriber" is informed, that we are always willing to publish the particulars of useful inventions without payment. His order on town for cash has been destroyed.

Errata.—In a few impressions of our last Number, p. 95, col. 2, line 8 from bottom, for "11," read "9,"—and line 6 from bottom, for "11," read "12."

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C. E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

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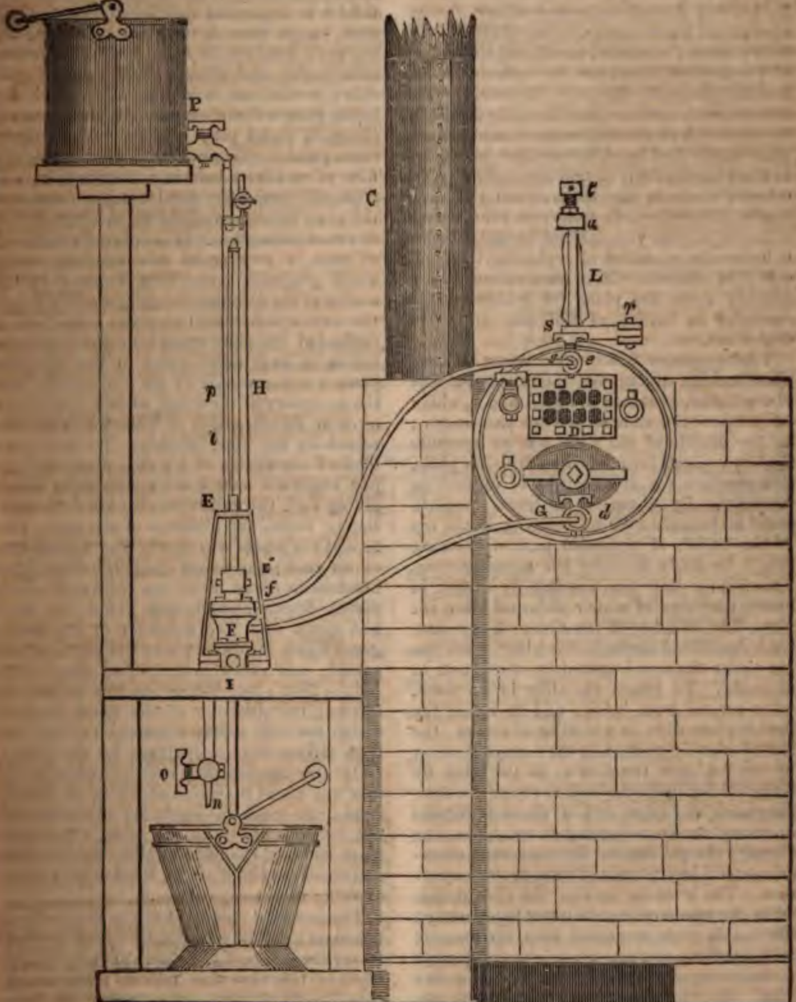
AMERICAN EXPERIMENTS ON STEAM-BOILER EXPLOSIONS.



(Fig. 3.)

REPORT OF EXPERIMENTS MADE BY THE COMMITTEE OF THE FRANKLIN INSTITUTE OF PENNSYLVANIA ON THE EXPLOSIONS OF STEAM-BOILERS, AT THE REQUEST OF THE TREASURY DEPARTMENT OF THE UNITED STATES.

(From the *Journal of the Franklin Institute.*)

(Continued from p. 106.)

The second part of the inquiry relates to the action of fusible plates when in place on the boiler; it supposes proper alloys, fusing at required temperatures, to be composed, and then studies the causes, modifying the action of them when placed on the boiler. In the first apparatus for the use of these plates the attempt was made to introduce them within the boiler, but the difficulty of replacing a plate which had fused by another plate, led to the abandonment of this apparatus. The opening made in the boiler, when the plate was withdrawn, was so great that the contents of the boiler were violently discharged through it before the operation of replacing the plate could be effected. This observation has a bearing upon the plans for making large openings in boilers of full size to avoid explosions.

The apparatus finally used was a sliding-plate, moving in a groove upon the upper side of the boiler, as shown in figs. 1 and 3, where *s* represents the slide moved by the lever *r*; in the middle of the slide was an aperture slightly conical, for receiving the fusible plate, this aperture was eight-tenths of an inch in diameter. By means of the lever, the plate could be brought over an opening in the top of the boiler, or the solid part of the slide might be made to cover the same opening. The fusible plate was covered by a disk of brass, the edge of which projected over the plate, and rested upon the slide. There were six holes drilled through this plate, each being about nineteen-hundredths of an inch in diameter. To retain the slide in its place, when pressed from below, and to retain the fusible plate when in a similar situation, the forked stem L, pressed in the former position by one leg upon the slide *s*, in the other by the other leg upon the disk covering the fusible plate; the upper end of the stem entered a cavity in an adjusting-screw *t*, passing through the gallows *u*; by this means allowance could be conveniently made for expansion. The lever for moving the slide rested, when the aperture in this latter for receiving the fusible plate coincided with the opening in the boiler, against an upright, projecting from the top of the boiler, and serving as a stop. By the use of this apparatus, the plates were applied very readily, were removed when fused, and the opening into the boiler closed with so much dispatch, as to prevent the foaming within from taking effect. The disk which covered the fusible plates prevented in part the loss of heat from the upper surface.

'The plates which were first cast were intended for low pressures, as most convenient for experiment, they were fifteen hundredths of an inch in thickness. The observations made upon the manner in which they acted when in place upon the boiler, led to the question of the effect of varying the thickness upon their use. When a plate of sufficient thickness to prevent its giving way to pressure, verges towards its point of fusion, the top part, which is in contact with the metal disk, melts, and flows over the holes in the disk; sometimes it accumulates until the liquid rolls off the plate. The temperature rising, a small pellet of the more perfectly fused parts is thrown out by the steam, the flow of which is instantly checked; this is repeated frequently, until a breach through the plate is made, and the uninterrupted flow of steam takes place. If the plate be removed at once, a very small hole appears, which would gradually have been widened by the action of the escaping steam, probably before the entire fusion of the plate. The under surface of the plate appears oxidised, and the fusion to have taken place at the top: the plate has contracted in its dimensions, and the periphery of the upper surface has lost its circular figure, which is tolerably well preserved by the lower surface. To give some idea of the extent to which a plate such as just supposed may lose its substance before giving way, two measurements are subjoined. Before fusion the diameter of the upper surface of the plates was eighty-four hundredths of an inch; the lower diameter eighty-two hundredths of an inch: the thickness of the plates, fifteen hundredths. After the plate had given way, the diameter of the hexagonal figure into which both the surfaces had passed, was about seventy-nine hundredths for the first, seventy-four hundredths for the second; the diameter of the lower surface, which was still nearly circular, was, for the first, seventy-six hundredths; for the second, sixty-nine hundredths; the thickness of the first was about twelve-hundredths, of the second, one-tenth of an inch; the thickness not being uniform in all parts. The first plate had lost, therefore, nearly three-tenths, and the second half of its substance, without allowing the passage of steam.

The observed oxidation of the lower side of the plate led to the supposition that it might retard the fusion of the plate, but no confirmation of this view was given by comparative experiments with plates of which the lower surface was brightened, and of others in which the same surface was highly oxidated, the thickness in each case being the same.

In the course of the experiments on the

effect of oxidation, the plates were much reduced in thickness by filing away the under surface, and the fusion of the thinner plates took place at points so much lower than those at which the thicker plates of the same alloy gave way, so as to require an examination of the cause.

Before proceeding with further detail, it may be well to state the general method of experimenting upon the plates. The stationary point of an alloy having been determined, and remarks made as to its point of fusion, plates were cast from it; and one of these being placed in the opening in the slide of the apparatus already described, was covered with the pierced disk, and the slide moved so as to bring the plate over the opening in the boiler. The steam was now raised, the temperature being noted from time to time, until the plate gave way; steam was then let off to keep the temperature from rising; the plate, which had just fused, removed, and one of an alloy, fusing at a higher temperature, substituted. The steam was again retained, and allowed to rise in temperature, the new plate pushed to its place, and the operation renewed. This course was continued until the alloy, fusing at the highest point of those prepared, had been used, or until the limit of the elasticity of steam, which could be produced in the actual condition of the boiler and state of the fire, was attained; steam was then let off, water thrown into the boiler, and a new series commenced. The tables which will be given required many days of trial and of close attention.

To try the effect of thickness on the fusion of the plates, three different thicknesses were cast of each of the alloys used; the first, or thickest, was fifteen-hundredths of an inch thick; the second, eight-hundredths; and the third, four-hundredths. There were five different alloys of tin, lead, and bismuth, composed; the stationary points of which, and the points at which they gave way in the boiler, appear below.

Number of experiment.	Number of alloy.	Temp. at which alloy begins to lose fluidity.	Stationary point determined by Committee	Thickness of plate.	Point at which the plates gave way in boiler.			Mean.	Pressures corresponding to the mean temperature of giving way.	
				Inches	Degrees Fah.					
1	1	275	250*		248	249†	249	248·3	1·9	* No true stationary point. Soft solid 250° to 254°. † Plate blown to pieces.
2	"			·08	243		251	245·5		
3	"			·15	250			250	1·05	
4	2	281⅝	268‡		263	258		260·5	2·3	‡ Had another stationary point at 207°.
5	"			·08	251½			254·5		
6	"			·15	295	295§	292	294	4·2	§ Piece of plate blown out.
7	3		284		287	288	285½	286·8	3·7	
8	"			·08	290	298		294		
9	"			·15	296	303	304	301	4·6	
10	4	314	309½	·08	299			299	4·5	
11	"			·15	303			303	4·7	
12	5	328	320		298	299	298	298·7		
13	"			·15	314			314	5·7	

The plates of Experiments 1, 2, and 3, were exposed to pressures tending to render them of less than one atmosphere; 1 and 3, the two extremes of thickness, show a great uniformity in the point at which they give way, and render it probable that some flaw, in casting the plate number two, caused its fusion at a lower point than that of either of the others; we see, too, that at these low pressures the fusing point in the boiler coincided very nearly with the point at which the alloy was a soft solid in the crucible. In this case the thinnest plates, when properly cast, were probably thick enough to withstand the small pressure to which they were exposed, and therefore did not give way at lower temperatures than the thickest, each attaining the temperature at which they were soft solids.

The next series, Nos. 4, 5, and 6, with a less fusible alloy, show, first, that the thinnest plate was too feeble to resist the pressure of steam, and gave way before the metal lost its solidity; second, that the plate, eight-hundredths of an inch, was probably defective, as it gave way at a lower temperature than the thinner plates of No. 4. No 6 presents a curious fact; the point of yielding of the

plate, given by four experiments, is actually above the point at which the alloy from which it was composed became liquid: this would appear inexplicable to one who had not attentively observed the mode of fusion of these thick plates, and would lead to the suspicion of error. The observation of the point at which the alloy became liquid, was, however, deduced from three trials; and four experiments, with the plates in place, are given, the extremes differing but three degrees. The explanation is to be found in the mode of fusion already spoken of; the more liquid parts of the alloy are forced out, the less fusible remain, and if strong enough to resist the pressure, the process goes on; this takes place unequally in different alloys. The importance of attending to such indications is obvious.

In the next series, the first thickness seems to have been decidedly too weak, and the second to have been hardly sufficient, while the third exhibits a point of fusion when the metal was in a softened state.

In the remaining experiments, both thicknesses were too inconsiderable to sustain the pressure, as appears by comparing the points at which the plates gave way with the stationary points. Something of this kind seems to have been deduced from practice in the use of these plates in France, for the last royal ordinance, in relation to the means of safety to steam-boilers, prescribes for the plates a thickness of not less than nine-sixteenths of an inch, making of them fusible plugs rather than fusible plates.

Experiments were subsequently made on plates of greater thickness, the use of which led to an interesting termination to this series of experiments. Before, however, stating the results thus obtained, some further experiments with the plates just considered will be described. These inquiries were directed to the effect which would be produced by the mode of casting the plates upon their fusibility; it being not improbable that rapid cooling might so modify the physical properties of the alloy as to change the fusing point from that of the same alloy when slowly congealed.

As low pressures afforded the most easy means of determining this point, plates were cast from the alloys of series No. 1, No. 2, and No. 3, and tried, in place, upon the boiler. Some of the plates were cast from metal at a high temperature, and the mould as cold as the perfect casting permitted; others, of the same alloy, in a heated mould allowed to cool slowly; and others from metal heated to a temperature as little above the point of fusion as possible. In the case of the higher temperatures, care was taken not to raise the heat so far as to oxidate rapidly either of the constituents of the alloys, thus changing the fusing point. A comparison of the results obtained showed no greater differences than those which have been seen to occur between plates similarly cast, and from the same alloy; and the conclusion derived was, that the mode of casting has no effect on the fusing point, which is appreciable in this mode of applying them. The French instructions expressly recommend to those who make or use boilers, to obtain plates in preference to the fusible metal in ingots; on the ground that it will be found difficult to procure plates of the same fusibility with the ingot, from that form of the alloy. This remark led to the experiments just referred to, and the explanation of it which they give, refers to the undue heating of the alloy in the casting of the plates, since they show that the particular mode of casting produces no difference worthy to be regarded in a practical point of view.

Plates were now cast quite thick, viz. one-fourth of an inch, of the alloy of eight parts of bismuth, eight of tin, and seven of lead; this alloy being intended to give way at a temperature corresponding to about one atmosphere of bursting pressure. The alloy was completely liquid at 275° Fah. and solid at 254° Fah.,* when examined in the crucible. The heat was raised as slowly as possible, so as to permit the full effect of the temperature indicated by the thermometer; the observations recorded are as follows. (See top of next page.)

The thermometer on top of the boiler dipped into the mercury in a small cistern, made by inclosing a space on the top of the boiler with clay; so that the top of the boiler formed the bottom of the cistern. The first plate having failed to give way until the temperature within the boiler was 21° above that at which the alloy, of which it had originally been composed, had been fluid, was examined with great care. The plate had decidedly given way to pressure, and not by fusion; it had lost its metallic lustre at the side where it was torn; yielded readily to the nail, which scraped off small particles. A piece of the plate being cut off and laid upon the top of the boiler, remained solid, though the portion which had oozed out was perfectly fluid near the same spot. The same remarks apply, generally, to the second plate. They afford a solution of the perplexing circumstances which had occurred throughout these experiments, and which had led to so many trials to discover their cause.

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* This alloy had no stationary point in passing from the liquid to the solid state: but some internal change in the solid at about 206°, produced a rise and stationary point at 208°.

Thermometer in Steam.		Therm. on top of Boiler.	Pressure.	REMARKS.
Therm.	Scale.			
Fahr.°	Fahr.°	Fahr.°	Atmos.	
256	58		2·2	Plate ¼th of an inch. Metal stands fused in the holes of the brass disk covering the fusible plate.
260		254		Steam issues in a very small stream through chinks between the fused metal and an unmelted part within.
270	58	262	2·7	Steam issues as before; no clear passage through the plate. Steam kept for a long time at this temperature. Six minutes elapsed in raising temperature 4½ degrees.
292		279	4·0	Plate gave way, affording a free passage to steam.
258				A second plate of the same composition and thickness, put in place; fluid metal stands in the holes of the cap.
267	83		2·6	Metal which has oozed out remains in a fluid state upon the sliding plate of the apparatus.
299	93		4·5	Plate gives way, torn in a thin part.

The portions of the metal which oozed out from these two plates had their fusing points taken, by gradually raising their temperature in a bath of oil, while the alloy rested on a small shelf of copper, wholly immersed in the oil. The first portions of fluid metal which had oozed from both the first and second plates, melted at between 221° and 223° Fah., being solid at the lower, and perfectly fluid at the higher, of these two temperatures. The second portion which oozed out from the first plate fused at between 230° and 233° Fah., and a portion of that from the second plate was fluid at about 235½° Fah. The parts which were left of the first plate were a soft solid, at 299¼°, fluid at one edge, at 312°, and entirely fluid at 345°.

The portions left of the second plate lost their cohesion, and could be broken by pounding into small particles or grains, at 300½°; and the whole was fluid at 356° Fah. A comparison of these results appears in the annexed table.

	First ooze.	Second ooze.	Residuum.	Entire plate before experiment.
	Fluid.	Fluid.	Fluid.	Fluid.
First plate . . .	223°	233°	312 *a* 345	254 *a* 275
Second plate . .	223	235½ *a* 241½	356	

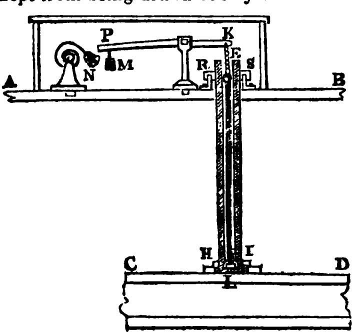
To pursue this subject further, by the clue thus obtained, only freeing the different oozes from accidental admixture, a small iron cylinder was made, closed at one end, and perforated near the closed end with a number of minute holes, not larger than the stem of a common pin. Into the cylinder was fitted, nearly tight, an iron piston, with a rod, to apply pressure. An alloy having been made and introduced into the cylinder, the whole could be heated in an oil bath to any desired temperature; and pressure being applied to the piston, the liquid parts would ooze out through the small apertures near the end of the tube. The first alloy experimented upon was the same in composition with that just referred to; being composed of eight of bismuth, eight of lead, and seven of tin, by weight. This alloy was fluid at 254½° Fah. At a temperature of 229°, some drops of fluid metal were forced out by pressure, and at about 239½° other portions were forced out. Both melted at 227° Fah. The portion left was a soft solid at 276¼° Fah.; fluid at 290½°. The alloy of one atom of lead, one of tin, and one of bismuth, is fluid at 273½° Fah., and that of one atom of lead, one of tin, and two of bismuth, at 219° Fah.

These experiments the Committee deem conclusive in regard to the use of fusible plates in the ordinary way; and they conceive that substituting fusible plugs of greater thickness, say half an inch, as has been directed by a recent ordinance in France, would not serve as a remedy to the defect thus exposed. The true remedy is to be sought in inclosing the fusible metal in a case, in which it shall not be exposed to the pressure of the steam, but only to its heating effect; the more fluid parts of the metal will then not be exposed to be forced out of the mass; and the whole will become fluid as if exposed to heat in a crucible. With this view of the subject, trial was made of an apparatus described by Professor A. D. Bache, in the *Journal of the Franklin Institute*, for October, 1832, under the title of an "alarm to be applied to the interior flues of steam-boilers."* This apparatus is obviously as applicable to a common boiler as to one with

* This paper was published in 1832, and the experiments of the Committee were made in 1833-4.

interior flues; the following description of it is given in the journal:—

"A tube of iron, or copper," according to the material of the boiler, "closed at the lower end, passes through the top of the boiler, its closed end reaching the flue to which it is attached."—"This tube, it will be observed, affords a ready access to the flue, to ascertain its temperature, without any restraint from packing."—"A mass of fusible metal placed at the bottom of the tube," "will become fluid very nearly as soon as the flue takes the temperature of fusion of the alloy."—"To show when the metal at the bottom of the tube becomes fluid, a stem is attached with a cord and weight," "or with a lever and weight."—"The weight and longer arm of the lever descending, may be made to ring a bell, or, by appropriate attachments, to turn a cock, permitting just enough steam to issue to give the alarm, and then to be closed at once. A projection on the lower end of the rod prevents it from being drawn from the metal until this latter is fused, and by widening the lower part of the tube, making it slightly tapering, the metal is kept from being drawn out by the rod."



In the annexed figure "A B is a section through the top of the boiler; C D, a corresponding section of its flue; E H represents a tube closed at the lower end, which is attached to the upper side of the flue. The mode of attachment by a projection on the tube and a ring screwed to the flue, is shown in the figure, as also the stuffing-box R S, through which the upper end of the tube passes. The lower part H I of the tube is made tapering, to retain the fusible metal. K L is the stem, the lower part being inclosed by the fusible metal, the upper part attached by a chain to a lever K P. The weight M draws the rod K L upwards, and on the fusion the alloy H I carries the lever below the bell N, which being attached to a spring, rings an alarm."

The form of this apparatus, which was subjected to trial by the Committee, was essentially the same with that described. One of the tubes in which the thermometers were ordinarily placed, was used to contain the fusible metal, and as giving the more severe test, the short one entering only into the steam was selected. For the convenience of removing the metal, it was placed in a metallic case, fitting loosely into the iron tube, and having a wire attached, by which it could be drawn out of the tube. This certainly diminished the sensibility of the apparatus, particularly as the case was quite as thick as the inclosing tube, and as there was a small space between its convex surface and that of the tube; it was required, however, for the convenience of the experiments.

The results of the several trials are contained in the following table. The temperature was registed by the adjoining thermometer dipping into the water of the boiler, and already often referred to; it was raised as rapidly as possible in all the experiments except the first. The first four trials were made on an occasion specially devoted to this purpose, the last two were made incidentally when upon another subject.

Number of Trial.	Temperature. Fah.°	REMARKS.
1	268	Stem rises. No particular attention paid to raising the temperature rapidly.
2	270	Stem rises. Steam raised rapidly.
3		Metal drawn out and suffered to cool, re-deposited cold in tube. Steam at 258°, and raised to 274° in $2\frac{1}{2}$ minutes.
	274	Stem rises.
4		Metal drawn out and cooled. Steam at 250°, when metal was replaced. Steam raised to 274° in 3 minutes.
	274	Stem rises.
	252	Metal had not become solid again. Steam let off rapidly.
5	270	Melted below this temperature.
6	256	Stem rises. Metal remains a soft solid, so that the stem can be drawn out until 240°.

A fact noticed during the experiments on fusible alloys was again verified in these experiments; namely, that the mixtures of metals require a considerable time to change their state of solidity or of fluidity; so that in the former case they may be heated above the true temperatures of fluidity, and in the latter case they may be cooled much below this temperature, without solidifying. The alloy used in these experiments appears to have put the apparatus very fully upon its trial in this respect, and the experiments were performed so rapidly as to give a further severe test. On the occasion devoted to the trials when the steam was not urged up with its greatest rapidity, the stem was drawn out at 268°, when more rapidly at 270°, and with the fire at its maximum intensity, when the water was raised in temperature 24° in three minutes, the stem was drawn out at 274°. In other experiments it gave way at 256°. The range is 18° Fah., corresponding at ten atmospheres, to less than two atmospheres, under the test of very severe comparisons. There appears no reason to doubt, that when tested by no more rigid modes than practice would furnish, this apparatus would not only apply as an alarm to prevent undue heating of the parts of the boiler, but as a manageable and useful check, in ordinary cases, upon the safety-valve.

Conclusions.

The conclusions deduced from the foregoing experiments on metallic alloys may be thus stated.

1st. The impurities of common lead, tin, and bismuth, are usually not such as to affect materially the fusing points of their alloys.

2d. When mixed in equivalent proportions, tin and lead formed alloys, not presenting the characters of distinct chemical compounds, in definite proportions. The alloys between the range of one equivalent of tin to one of lead, and one equivalent of tin to six of lead, varied considerably in the interval between the temperature of commencing to lose fluidity, and that at which a thermometer, immersed in the solidifying metal, became stationary. These different alloys produced nearly the same stationary temperature in a thermometer plunged into the solidifying metal.

3d. Fusible metal plates covered by a perforated metallic disk, and placed upon a steam-boiler, show signs of fluidity at the disk before the steam has attained the temperature of fusion of the alloy of which the plate is composed. This fluid metal oozes through the perforations in the disk, and the plate thus loses much of its substance before finally giving vent to the steam.

4th. The under parts of the plate are not kept from fusion by a protecting film of oxide there formed.

5th. The thickness of the plate is not important, provided only that it is sufficiently strong to resist the pressure of the steam at temperatures below its point of fusion.

6th. The temperature at which the plates are cast, and the rate of cooling of the cast metal, do not affect the temperature at which the plates give vent to steam.

7th. The effect stated in conclusion 3d is explained by the nature of the alloys used, which are formed of portions of different fluidities; the more fluid parts are forced out by the pressure of the steam, leaving the less fusible. These latter in general are burst, not melted.

8th. By pressure in a receptable provided with small openings, this effect of separating the differently fluid portions of an alloy may be imitated.

9th. Fusible alloys, used to indicate the temperature of any part of a steam-boiler, should not be exposed to the pressure of the steam; at least, not in such a way that the separation of the differently fusible constituents of the alloys may be effected.

Fusing Points of Alloys applicable to Steam-Boilers.

The Committee next proceed to give the results of their trials to determine metallic alloys proper to be applied to steam boilers. This problem admits, of course, of a great variety of solutions. The metals used were limited to tin, lead, and bismuth; but still different mixtures of these may be made which will give alloys of the same fusing point. The property which was most desirable in these alloys was a small range of temperature in changing from the liquid to the solid state. This property, it will be seen, is difficult to attain, and the less fusible alloys of the first table, as well as the more fusible ones of the third, do not possess it. For the higher temperatures, alloys of lead and tin are applicable, and the question is reduced to an examination of the fusing points of different mixtures. The greater proportions of lead might be inferred to give the higher fusing points, and the less proportions the lower ones. Beginning with the alloy of equal weights of tin and lead, the following table gives fusing points between 355° and 503° Fah. The stationary points were taken as already described; all the alloys in the table, except the first, were hard before the stationary point occurred, and therefore this point indicated, in these cases, some internal change in the solid, and did not correspond to the passage from the liquid to the solid state. This seems not to have occurred to Mr. Parke, who speaks of having taken this point as corresponding to that of congelation. It

should be observed, however, that his table of alloys shows a variety in the fusing points, which is incompatible with the observations of the Committee, supposing the stationary point to have been taken in each case as the fusing point.

The alloys passing gradually from the fluid to the solid state, an attempt was made to seize the more remarkable points, as referred to in the table; but these can only be considered as approximately determined. Direct experiments were, in most cases, made upon the temperature at which the metal refused to allow a metallic stem to be withdrawn. This was the case when the metal from the state of a soft solid, began to acquire hardness.

TABLE I.—*Alloys solidifying between 486° and 355° Fah.*

Eight parts of Tin to Lead.	Begins to lose fluidity.	Loses fluidity.	Stem draws out.	Falls to.	Stationary.	Eight parts of Tin to Lead.	Begins to lose fluidity.	Loses fluidity.	Stem draws out.	Falls to.	Stationary.	REMARKS.
8	393°	355°			355°	20	492	446	416*	351½	354	* 415°, with temperature rising.
10	430½	375½		354	355	23	521	480	466	352†	353½	† Hard solid, at 426°.
12	415	393	390	352	354	26	529	503	486	‡	353	‡ Hard at 437°.
16	475	429	405	352	354							

The next object was to diminish the relative proportion of lead, so as to determine the most fusible alloy of the two metals. The results obtained will be seen in the following table. The lead was the same in each case, namely, eight parts by weight.

Eight parts of Lead with Tin.	Liquid metal begins to thicken.	Stationary Temperature.	REMARKS.
Parts.	Fah.°	Fah.°	
8	364½*	352†	* Began above this point. † In these three cases the alloy congeals in thin plates, at the surface, and is a sandy solid below, at the sides. A liquid, with solid portions, at stationary temperature.
		353†	
		353½†	
9	368½	351	
10		354*	* Hardens in round masses, which, at the stationary point, are surrounded by a liquid.
	366½	352½*	
		352½*	
11		353¾	
12		353	
16		352	

The table of alloys by Parke, before referred to, gives a considerable variation in the melting points of the alloys in the above table. He makes the stationary point of the alloy of eight to eight, 372° Fah.; that of eight lead and ten tin, 352°; that of eight lead to twelve tin, 336°; this latter being the most fusible of the alloys of lead and tin. That the alloy, in equal parts, has not a fusing point varying much from that just given, the Committee were able to determine from various specimens of metal. With pure lead and grain tin, they found, for eight lead and nine tin, nearly the same as the foregoing, the stationary point to be, in different experiments, 355¼°, 356°, and 355½°. With one specimen of common lead the stationary point of an alloy of equal parts of lead and tin was 356° Fah. This lead melted at 606°, and the tin at 442½°. The Committee have no greater reason to suspect the accuracy of their other results. In all these cases the stationary point occurs when the metal begins to solidify.

It appears, then, by the foregoing table, that very little change is effected in the fusing point of the alloy of equal parts of tin and lead, by increasing the quantity of the more

fusible metal. A curious coincidence is shown between the stationary point of these alloys and of those in which the lead is increased. The two intervals, which are best determined in the table, between the temperature at which fluidity begins to be lost, and that at which the metal becomes solid, are 17° and 14°. When the lead becomes considerable in quantity, the passage from the fluid to the solid state is by such minute mechanical changes, as to extend through a long series of temperatures. This is even more especially the case when bismuth also enters largely int the alloy; instructive examples of which occur in the following table:—

Lead.	Tin.	Bismuth.		
20,	8,	8,	352°	Fused metal begins to lose fluidity.
			307	Soft solid, penetrable.
			279	Stationary point.
23,	8,	8,	358	Fused metal begins to thicken.
			280¾	Stationary.
40,	8,	8,	466½	Begins to thicken.
			368½	Is a soft solid.
			337¾	Hard solid.
			280½	Stationary point.
44,	8,	8,	474¾	Begins to thicken.
			429¾	Loses fluidity; is a soft solid.
			388¾	Hard solid.
			280½	Stationary.
48,	8,	8,	481	Thickens.
			440	Loses fluidity.
			280½	Stationary.

From perfect solidity to the greatest degree of fluidity of which the alloy was capable, required, in the case of the first alloy given above, about 70° of temperature: and between the temperature at which a solid could pierce the alloy, and the stationary temperature, was 8°. When the quantity of lead was doubled, the first interval was nearly 130°; and the interval between the temperatures of solidity and that at which the alloy could be penetrated easily, was about 20°.

These facts show, that in using fusible alloys, those should be preferred which contain the smallest quantities of lead: a similar reason would lead to the preference of those containing the smallest proportions of bismuth.

Tin is nearly liquid at the stationary temperature; hardens by plates or small masses, and becomes entirely solid at this same temperature.

Experiments were made to ascertain what quantity of bismuth could be added to tin without destroying the property just described. To one hundred parts by weight, of tin, one part, five parts and ten parts of bismuth, respectively, were added. The first alloy melted at 439½°, and had the general characters of tin in hardening; the second melted at 428°, and had these characters impaired; the third had no stationary temperature above 400°, and lost its fluidity by slow degrees.

As it was thus shown that alloys of tin and bismuth presented no peculiar advantages, the alloys for temperatures below 355° Fah. were sought by combining the least quantity of bismuth which would give any requisite temperature with one of the alloys of the table on p. 104. For this purpose the alloy of equal parts of tin and lead was selected, as having appropriate characters in its solidification, and melting at nearly as low a temperature as any of the others in the table. It does not, of course, follow, that this allow when combined with a given quantity of bismuth, will produce as low a fusing point as some other would; a question which, if it were worth deciding, experiment would determine. A few trials on this head were made by the Committee.

The following table gives the proportions of bismuth, which, added to an alloy of eight parts of tin and eight of lead, will give the temperature of the stationary points of an immersed thermometer between 355° and 326°. With the alloy which terminates this table the stationary temperature near the fusing point disappears, and another form of table is required for description.

TABLE II.—*Alloys of Tin, Lead, and Bismuth, melting between 355° and 326° Fah.*

Eight parts, by weight, of Tin, and eight of Lead.						
Bismuth.	Begins to lose fluidity.	Stationary point.	Bismuth.	Begins to lose fluidity.	Stationary point.	REMARKS.
0·0	393°	355°	1·0	262°	339¾°	All these alloys are liquid with solid portions, when the thermometer becomes stationary.
0·2	387	351	1·4	347	335	
0·4	375	349	1·8	343	331	
0·6	369	345¼	2·2	331	326*	* Slow, not stationary.
0·8		342¾				

The stationary temperature having disappeared with the increase of bismuth, the points attempted to be ascertained were these; the temperature at which the metal began to lose fluidity; that at which it ceased to be a liquid, as indicated by the surface not returning to a level when indented; that at which the solid ceased to be penetrable to a small rod by moderate pressure; and when it became hard. As these temperatures present nothing as definite as the stationary temperature, they are, of course, only approximate. A few trials made on the withdrawal of a metallic stem from the alloy, showed that the temperature at which this ceased to be possible was, for the alloys in the following table, between the temperature at which the metal lost its fluidity, and that at which it could not be penetrated by moderate pressure.

TABLE III.—*Alloys losing fluidity between* 313° *and* 246° *Fah.*

Eight parts, by weight, of Tin, and eight of Lead.									
Bismuth.	Begins to lose fluidity.	Begins to solidify.	Solid, not easily penetrated.	Hard solid.	Bismuth.	Begins to lose fluidity.	Begins to solidify.	Solid, not easily penetrated.	Hard solid.
2·6	326	313	307	301	5 4	296½	280½	270½	264¼*
3·0	321	313		297	6·2	294½	269	261†	246
3·4	316	309	301	295½	7·0	288½	257	252‡	238
3·8	311	306	298½	289½	7·6	283½	253	242§	234
4·6	301	291		271½	8·0	272	246	232‖	226

The fusing points of the metals used in the foregoing alloys were, of the tin, 442° Fah., of the bismuth, 506°, of the lead, 612°.

VI. *To repeat the experiments of Klaproth, relating to the conversion of water into steam, by highly heated metal.*

It being now well understood that an increase of temperature in a metallic surface may diminish the amount of vaporisation of a fluid placed upon it, the object of the following experiments was to study the phenomena attending the vaporisation of water by iron and copper, under different circumstances.

1st. To ascertain the temperature at which a given small quantity of water will be vaporised in the least time, by copper, with different states of surface.

2d. To ascertain the same point for iron, in similar circumstances.

3d. To extend these deductions to the effect of introducing different quantities of water into copper or iron vessels, varying in thickness, in character of surface and heated by different sources, to various temperatures.

A number of bowls, of these different metals, of as nearly the same figure as could be obtained, and of different thicknesses, were

* Stationary at 205°.
† Stem drew out at 264°.
‡ Stem drew out at 251°.
§ Stem drew out at 245°.
‖ Stem drew out at 235°.

provided. The bowls were portions of spheres, of nearly three inches radius, and were eight in number, three being of copper and five of iron; four of these latter were of wrought, and one of cast-iron. For applying heat to the bowls, a cylindrical vessel containing oil, and another containing tin, were provided; the former was about nine inches in diameter and four high, and the latter six and a half inches in diameter and four high. These vessels were heated by Mitchell's* alcohol lamp, or in the very high temperatures, by a charcoal furnace. The bowls were furnished with handles, which projecting, overlapped the edges of the cylinders, serving as baths for the oil and tin, and were thus kept in place.

The thermometers used in the experiments were carefully compared at the boiling point of water, and melting point of pure tin.

The experiments first to be detailed refer to the vaporisation of drops of water in copper bowls of different states of surface, from the smooth polish to the roughness of oxidation.

Vaporisation of Drops of Water by Copper.

1. The bowl, No. VII., of copper, seven-hundredths of an inch thick, was polished, but not very highly, and then placed in the tin bath while fluid; the tin, on solidifying, kept the bowl in its place. The thermometer was placed in a small cylinder of thin sheet-iron, containing mercury, the cylinder being as near the cup as possible. As the experiments progressed, the surface of the bowl became, of course, more and more tarnished; and after the two series of results recorded below were obtained, a third showed a marked effect from the oxidation, by the increased vaporisation. One hundred and twenty drops, nearly, from the tube used, made up one-eighth of a fluid ounce; the weight of one drop was, therefore, about ·47 of a grain.

Smooth surface. Copper bowl .07 inch thick.				
	Descending Series.†		Ascending Series.	
Temperature.	Drops on Centre.		Drops on Centre.	
Fah.°	Time.	Remarks.	Time.	Remarks.
	Seconds.		Seconds.	
315·3	5	On a polished part.		
317·3	3	On less polished.	3½	
319·8	> 2			
321·4	3		3 2½	
323·4			2½	
325·4			2	
327·5	2		1½	
329·5	2		1½	
331·5			2	
333·6	2½	Not repelled.	2	
335·6			> 2	
337·6				On a rough place, 1½ seconds.
339·7		Not repelled.		
341·7		A drop on side of bowl, 12 secs.		
343·8				
345·9				
348				
350	165	Repulsion perfect. Temp. rising to 360°.		
352				

* A very convenient alcohol lamp, with a draught through the wick, and a separation between the alcohol reservoir and the wick. The invention of Dr. J K. Mitchell.

† In this and other tables, the series marked descending, are those obtained when the temperature was falling; the ascending series were obtained while the temperature of the bath was rising.

The temperature of maximum vaporisation, under these circumstances, appears to have been between $327\frac{1}{2}$° and $329\frac{1}{2}$° Fah., the two series coinciding nearly in their indications; the repulsion is shown to have been perfect at 350°, the drop falling upon the centre assuming the usual rotary motion, and disappearing very slowly.

2. The surface of this same bowl was next highly polished with rotten-stone and oil, and a similar method of experimenting gave the following results, the same bath being used.

Polished Copper Surface.		
Descending Series.		
Temperature.	Drops on Centre.	
	Time in Secs.	Remarks.
445	210	Perfectly repelled.
370·5	177	Do.
331·6	157	Do.
318·3	25	Repulsion obviously lessened.
313·2	9	Repulsion not perfect.
300	4	
291·6	3½	
"	3	
285·5	4	
284·5	4½	
279·4	5½	
275·4	6½	
271·3	5½	
267·2	6	
255	16½	

(*To be continued.*)

NICKOLL'S PATENT CONDENSING RAILWAY LOCOMOTIVE.

Sir,—I beg to invite the opinions of your correspondents upon the following proposed improvements upon my plan (*Mechanics' Magazine*, No. 653), for a railway condensing locomotive.

The boiler being constructed and situated as before described and represented, I would substitute in the place of the two equi-angular cranked condensing engines, D, two double-acting high-pressure engines, with the addition of a condensing apparatus (consisting merely of an enlarged air-pump), which I would fix in the place of the condenser F; the apparatus in question, together with the hot water-pump, to be worked through the medium of a cross-head and separate cranked shaft, by an excentric from the shaft of the engines.

Concerning the refrigerator for cooling the hot water of the condenser, late experiments have convinced me, that to maintain the cooled water, even at the temperature 80° Fah., an evaporating superficies of full 200 feet per horse-power would generally be desirable.

It is not necessary to employ the draft of a furnace, or other means, to produce a current of fresh air in the refrigerator—for moisture, so far from loading the air with its weight, communicates, like heat, increased expansion and elasticity; consequently, as by reason of the heat and vaporisation of the hot water in the refrigerator, the specific gravity of the air therein would be lessened, so by a little elevation of the eduction air-chambers T, the refrigerator would establish a current of fresh air for itself.

With a given quantity of steam, I anticipate about one-twelfth greater effect by the employment of my high-pressure condensing, instead of the ordinary high-pressure locomotive; but the steam blast being wanting in the condensing locomotive, the expenditure of fuel might perhaps exceed in a sixth ratio what might be required in an uncondensing locomotive; the ultimate economy, however, (to pass by other well-known inconveniences of the steam blast,) I apprehend to be more than questionable, because of the powerfully exfoliating influence of the very intense heat which the blast occasions upon the thin and oxygenisable material of which locomotive boilers are, and, with our present knowledge of metallurgy, must be constructed. Yet, if in no other point of view, assuredly as respects economy in the item of water, the superiority of my condensing, as compared with the ordinary locomotive, may be admitted—first, on the ground of the presumed somewhat more economical application of the steam; secondly, from the cooling influence of successive currents of fresh air upon the hot water of the refrigerator; and thirdly, from the vaporisation of a given weight of water, say of the temperature 100° Fah., (according to what one may infer from lately published experiments of Desormes), absorbing about one-third more caloric, than steam evolved of four atmospheres elasticity.

I am, Sir,

Your obedient servant,

J. W. NICKOLL.

RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal*, for February.)

MAKING SHOES, AND RENDERING THEM IMPERVIOUS TO WATER, *Ernst G. Augustine, New York.*—The soles, we are told, "may be made of plaited flax, hemp, or the inner bark of the linden tree. For the upper part any kind of cloth may be used, and the shoes lined with linen or cotton. The soles are then varnished or covered with the following composition:—One quart of flax-seed oil, two ounces of rosin, half an ounce of white vitriol, which must be boiled together for half an hour. After which take four ounces of spirits of turpentine, and two ounces of white oak saw-dust, which has been exposed twenty-four hours to the sun: mix these ingredients well together, and put them on the soles of the shoes with a brush, or in any other way, which when dried will render them impervious to water."

The claim is to "the above-described method of making shoes and rendering them water-proof." We do not discover any method of "making shoes" contained in the foregoing description.

CLEANING WOOL FROM BURRS, &c., *M. N. Simpson, Boston, Massachusetts.*—After giving a description of the machine intended to be used, the patentee observes, that "wool from South America, and indeed almost all wools, have more or less of a vegetable substance, called burrs, so attached to it, that it is not taken out by washing, and therefore the only mode of cleaning the wool has been by hand, until about two years since, a mechanic of the city of Boston, Mr. Lemuel Couillard, jun., invented a machine for the purpose, which performed the part of taking out the burr very well, but was set aside from the injury the staples received. The machine for which I now wish a patent performs the work of taking out the burr without any injury to the fibre. The wool should in the first place be well pinched by a common wool-pincher, with the burr in it, and in this state the machine receives it; it is placed by the operation on the feed-belt, which when the machine is in operation is conducted to the draw-rolls, which revolve very slow, and as the wool is carried through the draw rolls, the card cylinder takes it in small quantities in a thin state, as it revolves with so much greater rapidity than the feed-rolls, and carries it in a continued direction by the clipper-frame, which is placed nearly in contact with the surface of the teeth; the burrs and all foreign substances are stopped by the blade of the clipper-frame, and the swift revolution of the clipper knocks them off. The wool continues in the teeth of the card-cylinder, and is overtaken by the fan which is placed on the opposite side of the clipper-frame, and is by the fan blown or taken from the cylinder, and deposited in a clean state in the room which may be made for the purpose."

It is stated that the machine may be much varied in form whilst the same effect will be produced; and the patentee says, "I do not therefore claim as my invention any particular form of machinery to effect the object of detaching burrs or other foreign substances from wool, but claim the application of knocking, blowing, brushing, or striking the burrs or other foreign substances from the surface of the card-teeth, or any other kind of teeth."

We think this claim may prove too broad, as Mr. Couillard some time ago claimed, among other means, the "blowing or striking them off," when properly exposed; it may be, however, that in the present machine the removal being effected from "the surface of the card-teeth," may so far modify the thing as to prevent the one patent interfering with the other.

BENDING OR SETTING FELLOES FOR THE WHEELS OF CARRIAGES, *Edward Reynolds, Haddonfield, New Jersey.*—The patentee says, "What I claim as my invention is the machine, or apparatus, as herein described, and may properly be denominated revolving cylinders, to be used for the bending of felloes for carriages and waggons of all descriptions; sleigh-runners; iron tires for wheels; coopers' set-hoops, vessels' mast-hoops, &c. In which machine two cylinders are employed, operated together by means of certain accessary parts, in the manner, or upon the principle, herein set forth."

We think the machine described well adapted to the bending of timber for rims for wheels. It consists of two wheels in a strong frame, the peripheries of the wheels being nearly in contact with each other; the timber, prepared by boiling, or steaming, is to be bent round one of them, by turning the other, which presses forcibly upon it. An iron band laps round the outside of the bent timber, to prevent its checking; and there are proper staples, and other appendages, for the management of the process.

ROLLING UP CURTAINS, MAPS, &c., *Henry Lawson, Boston, Massachusetts.*—The handle by which the curtain, &c. is to be rolled upon its roller, is made much in the form of the old fashioned bell-pull, and has a small sheeve, or pulley, at its upper end; a cord, one end of which is fastened to and winds round the end of the roller, passes through the pulley, and has its other end fastened to a pin, or other attachment, above: this whole arrangement, it will be seen, is exactly similar to the hanging the weight of a common eight-day clock.

"My claim is, 1st, for reducing the length of the draw required to roll up this species of roller-blind, shade, curtain, map, &c. to a convenient band's pull; that is, by one easy move of the hand, to cause the roller to revolve sufficiently to wind up any length of curtain &c. required for the above purposes.

"2nd. For the pendent balance-pulley, and the manner of applying it, as above described.

"3d. For the relative proportions of the barrel and axis, as above described."

All that is said about relative proportions is that one part is made *small*, and another *greater*. Rather an indefinite thing to claim.

Improvement in the Manufacture of Cloth, *Freeman Wolcot, Stow, Massachusetts.*—This, so called, improvement in the *manufacture of cloth*, is, it appears, an improvement in the napping-apparatus, by substituting combs of brass for the teazles usually employed in that process. These combs are made of strips of elastic sheet brass; the teeth in them are to be about an inch in length, a fifteenth of an inch wide at their bases, and tapering regularly to a point. To these plates "a considerable curvature is to be given by swaying; that is, by placing the plate thus cut over a concave mould so fashioned as to give the teeth and plate a proper curvature, and then placing a corresponding convex iron over them, and giving it a blow with a hammer. The metallic napper will then be complete, and will be a plate with a row of curved tapering elastic teeth, resembling the teeth of the teazle, and standing out from the uncut part of the plate at such an angle that the uncut part may be attached to slats of wood passing across [along] the face of a cylinder at suitable distances."

"The invention for which, and for the use of which, the said Wolcot claims his patent, is for making from thin brass a plate, with curved, tapering, and elastic teeth suitable for napping cloth."

Machine for Manufacturing Corks, *Jonathan Cutler, and Isaac Keyes, Putnam, Vermont.*—This cork-cutting machine has a mandril which revolves like that of an ordinary lathe. The cutters consist of four or any other convenient number of pieces of steel formed at their ends like an ordinary gouge. They are capable of expanding and contracting, as otherwise they would cut the cork into a cylinder instead of making it conical. Each of the cutters is hinged, by a handle at its opposite end, to the revolving shaft, and there is a collar so contrived as to cause the cutters to approach each other as the cork is cut. In front of the mandril there is a horizontal wheel, called a feed-wheel, around the periphery of which there are notches to receive the blocks of cork-wood which are ready for the machine. A cam causes this wheel to carry each block, in succession, up to the cutters, into the hollow between which it is finally received, and passes out at a proper opening behind the cutters.

"What we claim as our own invention is the expansive, or cutting cylinder, as connected with the other machinery. Every other part of the machine may be constructed differently, and answer the same purposes."

This machine is skilfully contrived, and described with sufficient clearness; the claim, also, we think well expressed and sufficiently guarded; still we have doubts of the eventual success of the plan, from the intrinsic difficulties which present themselves in the cutting of cork by machinery. There have been several patented contrivances for the same purposes, but we believe that none of them has stood the test of continued use. Those who are acquainted with the operation of cutting corks by hand know that a thin and sharp knife is employed for the purpose, and that the edge of this knife is preserved by passing it over a piece of wood between every two or three cuts, the workmen doing this dexterously with one hand whilst the other is employed in taking up a fresh block; without this fine edge the cutting cannot be effected, and we think that in a machine it can scarcely be preserved. Besides this, from the varying thickness of the cork-wood, it is no easy matter to have the blocks all of one size. In cutting by hand this is of no consequence, while in cutting by machinery it is all-important.

Improvement in the Construction of Stoves for Burning Anthracite, and other Fuel, *Jordan L. Mott, New York.*—"For the purpose of description," says the patentee, "I will suppose a vertical, cylindrical stove to be constructed. The body, or furnace part, of this stove, is to be of cast-iron, and consists of any required number of separate rings, of such internal diameter as may be required for the furnace. These rings are to be placed, or super-imposed, upon each other to the required height; rims, or ledges, and corresponding grooves, or hollows, being cast upon their touching sides to keep them in their places. Holes are also to be cast in them, or ears formed on them, to receive rods, by which they may be confined together. The lower part of the stove, forming the ash-pit, and its appendages, and also that part which is above the fire, may be constructed in any of the usual forms, or of any of the ordinary materials; the improvement made by me consisting entirely in the construction of that part which

is formed of rings, or rims, in the way described.

"I intend usually to form these rings so that, when put together, the interior of the furnace shall, by their junction, have a uniform, continuous surface, either cylindrical, conical, or otherwise, whilst the outside shall be fluted, ribbed, or grooved, so as to expose a large surface to the action of the external air, as this mode of forming them will, by its extended radiation, tend to prevent their being over-heated.

"When used for gas-retorts, their outsides will form one continuous surface, as best calculated to receive the action of the fire by which they are to be heated. When used in tubes for the conveyance, distribution, or management, of heat, they must, of course, be so formed as to adapt them to the particular purpose to which they are to be applied.

"What I claim as my invention, and desire to secure by Letters Patent, is the forming the exterior, or shell, of furnaces, or fire-places, for stoves of various kinds, the bodies of gas-retorts, and other apparatus which are to be exposed to great alterations of temperature, by the combination of separate rings, rims, or frames of metal, usually of cast-iron, by which means any difference of expansion in the respective parts may take place without the danger of breaking, whilst any portion which is defective may be easily removed, and its place supplied."

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 28TH OF APRIL AND 24TH OF MAY, 1836.

John Burns Smith, of Talford, Lancaster, cotton-spinner, for certain improvements in the machinery for roving, spinning, and twisting cotton and other fibrous substances. Sealed April 30; six months to specify.

John Whiting, of Rodney-buildings, New Kent-road, doctor of medicine, for an improvement or improvements in preparing certain farinaceous food. May 3; six months.

John Macneill, of Parliament-street, civil-engineer, for improvements in making or mending turnpike or common roads. May 3; six months.

Henry Sharpe, of Broad-street-buildings, London, merchant, for improvements in sawing wood and other materials; being a communication from a foreigner residing abroad. May 3; six months.

William Sneath, of Ison Green, Nottingham, lace-maker, for certain improvements in machinery, by aid of which improvements thread-work ornaments of certain kinds can be formed in net or lace, made by certain machinery commonly called bobbin-net machinery. May 3; six months.

William Augustus Howell, of Ramsgate, Kent, smith and ironmonger, for certain improvements in the construction of springs for doors. May 3; six months.

Thomas Henry Russell, of Took's-court, London, tube-maker, for improvements in making or manufacturing welded iron tubes. May 3; six months.

Edmund Pontifex, of Shoe-lane, London, coppersmith, for an improvement in the process of making and refining sugar; being a communication from a foreigner residing abroad. May 5; six months.

Joseph Banister, of Colchester, Essex, watchmaker, for improvements in watches and other time keepers. May 7; six months.

John Elvey, of Canterbury, Millwright, for certain improvements in steam-engines. May 7; six months.

Matthew Hawthornthwaite, of Kendal, Westmoreland, weaver, for a new mode of producing certain patterns in certain woven goods. May 7; six months.

Thomas Taylor, of Banbury, Oxford, saddler and harness-maker, for certain improvements in saddles for riding. May 7; six months.

Luke Hebert, of No. 20, Paternoster-row, London, for improvements in horse-collars; being a communication from a foreigner residing abroad. May 9; six months.

John Hague, of Cable-street, Wellclose-square, engineer, for an invention for raising water by the application and arrangement of a well-known power from mines, excavations, holds of ships or vessels, and other places where water may be deposited or accumulated, whether from accidental or natural causes, and also applying such power to and in giving motion to certain machinery. May 9; two months.

Richard Waddington and John Hardman, of Bradford, iron founders, for an improved method of making and constructing wheels for railway carriages. May 10; six months.

Richard Birkin, of Basford, Nottingham, lace manufacturer, for certain improvements in machinery for making lace, commonly called ornamented bobbin net lace. May 11; six months.

Richard Wilson, of Blyth Sheds, Northumberland, builder, for improvements in making or manufacturing fire-places, slabs, columns, monuments, and corrices, such as have heretofore been made of marble. May 12; six months.

Thomas Grahame, of Nantes, France, but now of Suffolk-street, Pall-Mall, gentleman, for improvements in passing boats and other bodies from one level to another. May 13; six months.

—— Ashdowne, of Tunbridge, Kent, gentleman, for improvements in apparatus to be added to wheels to facilitate the draft of carriages on turnpike and common roads. May 13; six months.

Wheatley Kirk, of Commercial street, Leeds, music-seller and manufacturer of piano-fortes, for certain improvements in piano-fortes. May 14; six months.

Joseph Whitworth, of Manchester, engineer, for certain improvements in machinery for spinning and doubling cotton, wool, and other fibrous substances. May 17; six months.

David Fisher, of Wolverhampton, mechanic, for an improvement in steam-engines. May 17; six months.

Henry Walker Wood, of No. 29, Austin-friars, London, merchant, for certain improvements in certain locomotive apparatus. May 17; six months.

James Brown, of Esk Mills, Pennycuick, North Britain, paper maker, for a certain improvement or certain improvements in machinery or apparatus for making paper. May 18; six months.

Thomas Beck, of Little Stoneham, Suffolk, gentleman, for new or improved apparatus or mechanism for obtaining power and motion, to be used as a

mechanical agent generally, which he intends to denominate Rotæ Vivæ. May 18; six months.

Pierre Barthelemy Guinibert Debac, of Brixton, Surrey, civil-engineer, for improvements in railways. May 18; six months.

Henry Elkington, of Birmingham, Warwick, gentleman, for an improved rotary steam-engine. May 23; six months.

William Watson, of Leeds, dyer, for an improvement in dyeing hats by the application of certain chemical matters never before applied to that purpose. May 24; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 21st OF APRIL AND 21st OF MAY, 1836.

Frederick Edward Harvey, of the Horseley Iron-works, Tipton, Stafford, mechanical draftsman, and Jeremiah Brown, of Tipton, roll-turner, for certain improvements in the process and machinery for manufacturing metallic tubes, and also in the process or machinery for forging and rolling metal for other purposes. Sealed April 22, 1836.

William Maugham, of Newport-street, Lambeth, alchymist, for an invention of certain improvements in the production of chloride of lime and certain other chemical substances. April 25.

Thomas Ridgway Bridson, of Great Bolton, Lancaster, bleacher, for a certain improvement or improvements to facilitate and expedite the bleaching of cotton, linens, and other vegetable fibres. April 25.

Joseph Lidel, of Arundel-street, Panton-square, Middlesex, professor of music, in consequence of a communication made to him by a foreigner residing abroad, for certain improvements in piano-fortes. April 28.

Andrew Smith, of Princess-street, St. Martin's-in-the-Fields, engineer, for certain improvements in engines for exerting power for driving machinery and for raising and lowering heavy bodies. April 28.

James Burns Smith, of Salford, Lancaster, cotton-spinner, and James Smith, of Halifax, dyer, for a certain method or methods of tentering, stretching, or keeping out cloth to its width, made either of cotton, silk, wool, or of any other fibrous substances, by machinery. April 28.

Robert Copland, of Brunswick-crescent, Camberwell, Esquire, for improvements upon patents already obtained by him for combinations of apparatus for gaining power. May 6.

William Preston, of Sunnyside, Lancaster, operative calico printer, for certain improvements in printing of calico and other fabrics. May 10.

Henry Sharpe, of Broad-street-buildings, London, merchant, in consequence of a communication by a foreigner residing abroad, for improvements in sawing wood and other materials. May 10.

James Cropper, of Nottingham, lace-manufacturer, and Thomas Brown Milnes, of Lenton Works, Nottingham, bleacher, in consequence of a communication by a foreigner residing abroad, for certain improvements in machinery or apparatus for embroidering or ornamenting bobbin-net or lace, or cloths, stuff, or other fabrics made from silk, cotton, wool, flax, or hemp. May 10.

Jacob Perkins, of Fleet-street, London, engineer, for improvements in the apparatus and means for producing ice and in cooling fluids. May 13.

William Gossage, of Stoke Prior, Worcester, alchymist, and Edward White Benson, of Wichbold, alchymist, for an improvement or improvements in the process of making or manufacturing ceruse or white lead. May 20.

NOTES AND NOTICES.

Geology.—In consequence of the representations addressed to Government in July last, that the officers employed on the trigonometrical survey of Great Britain would have constant opportunities afforded them of collecting specimens illustrative of the application of geology—or, in other words, of the mineral wealth of the country—to the useful purposes of life, it has been determined to form a museum for the reception of such specimens from time to time, and to place them under the Department of Woods and Works.

Paddington Steam Omnibus.—Mr. Hancock's carriages still continue to run between Paddington, Islington, and the Bank. The results of the week's traffic have been somewhat similar to our former statements.

Improved Method of Casting Brass Burrs.—The usual method of accomplishing this object is to place the screw in a mould of the required form, and to cast the brass about it, by which means a very perfect burr may be produced, but there is frequently great difficulty in removing it from the screw. To avoid this, it is proposed to cast a lead burr in the usual way (which may be easily taken off), and to use it as a box for the formation of a sand *core*. After the box is filled, it is subjected for some hours to the heat of the drying-stove, and when its contents are found to be perfectly free from moisture, the whole is plunged into the melted lead, which robs the core of its casing, and renders the sand copy fit for use instead of the original screw: by this means the difficulty above alluded to is entirely obviated.—*Third Report of the Cornwall Polytechnic Society.*

Communications received from Mr. Badeley—Clovis—Mr. Hodson—Mr. Hill—Mr. Skene—M. F. de Pourquet—A Country Teacher—H.—P. P. C. R.—Mr. Dickson—Mr. R. Simpson.

Errata.—In Iver M'Iver's article, pp. 105 and 106, for "V^0, V^1, V^2," &c., read "V_0, V_1, V_2," &c.; and for "m^1, m^2, m^3," &c., read "m_1, m_2, m_3," &c.

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C.E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

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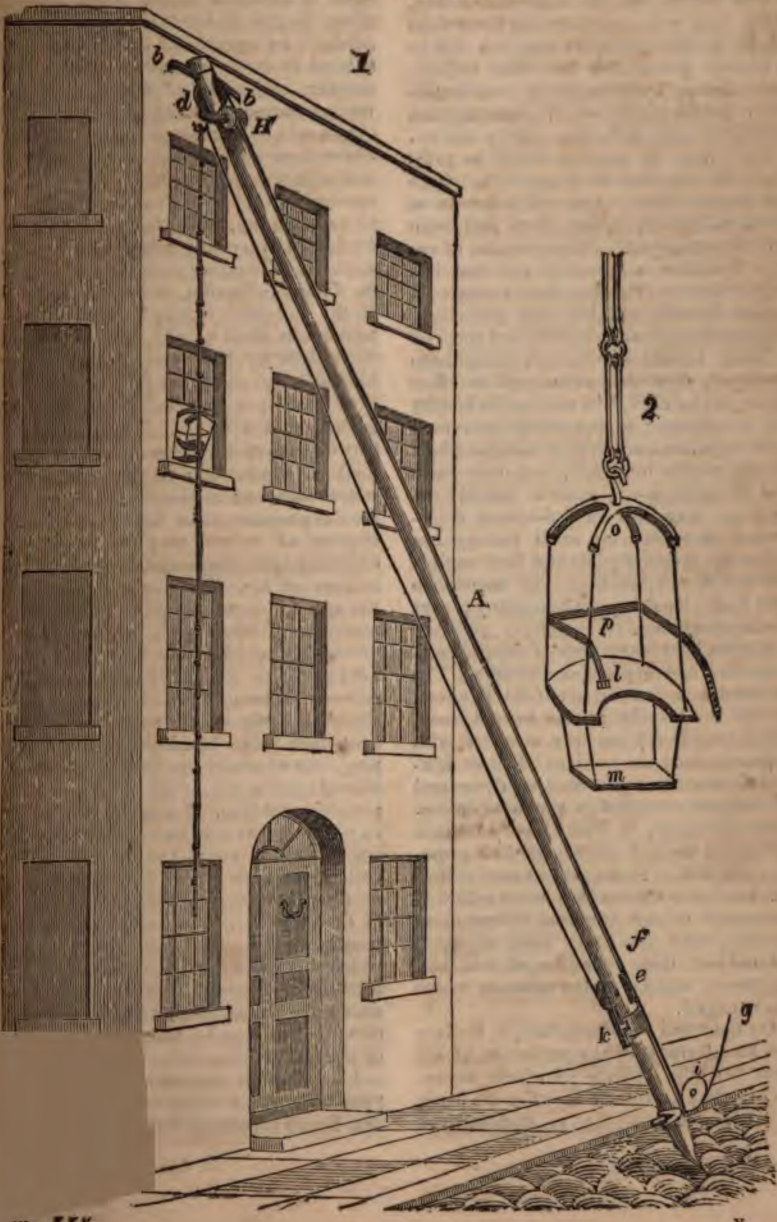
FORD'S FIRE-ESCAPE.



FORD'S FIRE-ESCAPE.

Sir,—The uninformed and unthinking portion of mankind are continually railing against science, and accusing it of indifference to the claims of humanity; especially whenever any recent calamity is rife in the public mind.

The fact is, the life-boat—the safety-lamp, and a thousand similar inventions might be cited, to prove that this charge is utterly groundless and most unjust; but, passing by these, and numberless other instances, in which humanity has been protected and preserved by the benignant hand of science, it will be sufficient for my present purpose to name one subject alone, upon which minds of every calibre have for years past been actively employed. The question of escape from fire is certainly one that has engaged more attention, and occupied a greater diversity of talent than almost any other, and necessarily with varied success.

Many inventions, indeed, have been produced, very well calculated to effect the object in view, had not public apathy and indifference to the matter prevented their introduction. Nor is this the whole extent of the mischief; not only have *new inventions*—calculated greatly to facilitate escape from fire—been disregarded, but the very same feeling has led to the most culpable and fatal neglect of "all the appliances and means to boot" (such as they are), in many places already provided.

A somewhat better state of things, however, now appears to dawn upon us. In the south-western district of St. Pancras, a local fire-association has been formed, whose exertions have been attended with unprecedented success; an efficient fire-engine has been provided, and several fire-escapes stationed in the most convenient situations, to afford every needful protection to that respectable and populous district. The noble example thus set, has been, and is now being followed by several of the principal metropolitan parishes, who appear to have taken up the subject with a degree of zeal and judgment, worthy of the cause in which it is engaged.

On the 22nd of March last, a Society was also formed for the protection of life from fire, the objects of which are:—To organise and train an effective body of men, who shall be so disposed, in different parts of the metropolis, as to be promptly on the spot in all cases of fire, and whose sole object shall be the preservation of human life—To examine into, and ascertain the merits of, the different inventions which may be presented to the Society's notice, as calculated to facilitate escape from fire—To adopt for the Society's use, such escapes as shall be capable of being externally applied in the most ready and efficacious manner, and which shall be kept at convenient stations under the charge of the Society's men—To recommend to public notice such escapes as shall appear to be the best to be provided by individuals, and kept in dwelling-houses for use in the absence of external aid, and also to diffuse information in every way relative to the best methods of insuring the safety of persons in danger—Finally, to bestow rewards, at the discretion of the Society, on such persons as shall at any time distinguish themselves by their endeavours to save human life in case of fire.

When the St. Pancras Fire-association advertised for fire-escapes, upwards of fifty different contrivances were submitted for their inspection; the examination of which occupied a committee, appointed for the purpose, three days; at the conclusion of which, they decided upon adopting the improved portable fire-ladders of Mr. Merryweather, and also the spar-fire-escape of Mr. Ford. This invention of Mr. Ford's, which had been previously adopted with much success in Liverpool, is decidedly the best *fire-escape* hitherto before the public; for although some of the parts, separately, have been before employed for the purpose, the whole in combination possesses advantages never before attained in so simple a machine. I would just observe, *en passant*, that any Society for protecting life from fire, could not do better than collect, with the utmost diligence, models or illustrated descriptions of every kind of fire-escape that has hitherto been proposed, that would-be-inventors — with which this branch of humane science at least is completely overrun—might at once satisfy themselves of what has been done in this way by others in the course of the last half century.

I have much pleasure in laying before your readers the following description of Mr. Ford's ingenious invention, that they

may become acquainted with the existence, and familiar with the use of this simple and effectual apparatus.

In the accompanying sketch (fig. 1), is a representation of Ford's escape raised and ready for action. It consists of a tough, well-seasoned spar, A, from thirty-five to forty feet long, according to the average height of the buildings in the particular locality where it is to be stationed. At the upper part, the spar is capped with iron, from which two arms, *b b*, project, furnished with prongs, which give the spar a firm bearing upon the wall of the building against which it is raised; the lower end is shod with iron, terminating in a strong spike *c*, for ensuring perfect stability at the base. Just below the cap at the top of the spar, a grooved wheel or pulley *d* is mortised into the spar, and a corresponding pulley *e* is similarly placed near the bottom. Round these two pulleys runs an endless rope, to which a main rope *g* is attached at *f*; the opposite point of the endless rope is fastened to the semi-circular brace of a large grooved roller or traveller H, which traverses up and down the spar between the two pulleys *d* and *e*. This brace carries a hook on the under side of the spar, to which a convenient cradle is affixed for the reception of the party to be lowered. If the persons to be brought down are at the upper windows of a house, the cradle is mostly attached directly to the hook, but if relief is to be afforded at any of the lower windows, a chain is attached to the hook, and the cradle affixed at such a distance from the top, as to effect the desired communication. The chain employed for this purpose is one of Mr. Ford's invention, and is of very ingenious construction, and well calculated to ensure great strength and durability; it is a kind of double chain, and each of the links being exactly twelve inches long, greatly facilitates the adjustment of the cradle at a suitable distance from the top.

This escape being brought to the spot where it is required to be used, has first to be raised; this can very readily be done by either two or three men; the cradle (either with or without the chain, as the case may require,) having been attached to the hook, is raised by pulling the rope *g* (which for convenience is led through the pulley *i*), until the needful elevation is obtained. The cradle being freighted, is lowered gently by gradually slacking the rope. There is a cleat on each side of the spar, as at *k*, for hitching the rope on, either for the purpose of keeping the cradle suspended at any required point, or to afford additional friction for checking the too rapid descent of heavy weights.

Fig. 2 is an enlarged sketch of the cradle, consisting of a seat *l*, and foot-board *m*, suspended from a cross-head *o*; a strong belt P surrounds the body of the cradle, and buckles in front to secure the persons seated within.

This escape, when complete, weighs about ninety pounds; two persons, therefore, can easily carry it from place to place; that number also being sufficient to raise the spar and work the cradle. By this machine assistance can always be sent up from below to the persons in danger, and three individuals can descend at once in perfect safety.

It will be observed, that the spar forms an inclined plane, or railroad, upon which the roller H runs, carrying part of the weight, the other portion being sustained by the pulley *d*; and in this respect, Ford's escape differs from, and surpasses all others in which poles were proposed to be employed. The descent being necessarily in all cases diagonal—i. e. parallel to the spar—the moment the cradle begins to descend, it recedes from the building, thereby clearing railings, areas, flames issuing from lower windows, &c.

This fire-escape is complete in itself; it requires no adventitious aid nor previous provision, but affords, under all circumstances, a perfectly safe and unobjectionable mode of descent, and possesses, in a very high degree, those qualifications, which the most competent authorities have declared essential to constitute an efficient fire-escape.

The inventor proposes to use this machine for those purposes for which ladders are usually employed, and I doubt not there are many occasions where it would be found exceedingly useful and much more convenient than ladders.

I remain, Sir,

Yours respectfully,

W. BADDELEY.

London, May 17, 1836.

NEW HOUSES OF PARLIAMENT—METROPOLITAN IMPROVEMENTS, &c.

Sir,—At length the anxiously looked-for approved design of Mr. Barry for the new Houses of Parliament has been submitted to the public by the appearance of authentic engravings of the plan and elevation in the last Number of the *Athenæum;* and to the majority, I am convinced, the "great design" will prove a great disappointment. However superior the elevation, as it now stands, may be to that which was originally submitted to the Committee, there will hardly be found many to consider its erection, even in its present state, as an "honour to the age"—if I may judge of what are likely to be the sentiments of the public in general from the sentiments of a private circle, which may be taken as a fair average of the public. The long, long line of almost unvaried uniformity which stretches along the river—if "Elizabethan" to the letter, certainly very un-Elizabethan in spirit—will scarcely present so pleasing an appearance as the picturesque variety of the old range of building, with its grotesque intermixture of trees and towers. But this is mere matter of taste, and as, according to the old adage, tastes are not to be disputed about, I will pass on to make a few remarks of a more tangible and less disputable nature.

The principal and most striking feature of Mr. Barry's design is, undoubtedly, the gigantic "Record Tower," 300 feet high, which it is proposed to erect over the King's Entrance. The principal object of this feature is to give architectural importance to the new buildings; and amidst so vast a range of edifices as will be formed by the new Houses of Parliament, in conjunction with the old Hall and Abbey, some considerable tower or spire is, undoubtedly, required to form a centre around which the other objects may group. But has Mr. Barry in this instance chosen the proper position for this keystone of his arch? Whoever has viewed the Abbey from any other position than immediately in front of its western towers, must have been struck with the not only evident, but absolutely glaring want of a middle tower or spire; a want which Sir Christopher Wren had already begun to supply more than a *hundred years ago, when obliged* to stop short by the niggardliness of the age. The spire which he intended to erect was to have been similar to that of old St. Paul's, with which we are all familiar from the views of that ancient boast of London. Were Sir Christopher's proposals now carried into effect, the ancient and modern boast of Westminster would, for the first time, present an exterior appearance worthy of its fame—and, at the same time, the architectural centre demanded by Mr. Barry would be supplied. Seen from the point from which the view in the *Athenæum* is taken, the spire would rise almost exactly over the middle of the Parliamentary buildings. On the other hand, if the new "Record Tower" be built as at present proposed, the Abbey will not only remain in its present awkwardly incomplete state, but all hopes of its ever being completed will be taken away, for a spire and tower so excessively near each other would injure each other's effect. The new building would thus actually be prejudicial to the architectural ornament of its neighbourhood; although the sole purpose of its erection would be ornament, certainly not use. In fact, the proposal to erect a repository for the records at a distance from *terra firma* full five-sixths, as the *Athenæum* assures us, of the height of St. Paul's, does *almost* seem intended for a covert satire on the usefulness of the documents for which this lumber-room of a hundred feet square is to be provided. Surely if they are intended to be consulted oftener than once in ten years, some little consideration for the comfort of the consulters would prevent this unconscionable demand upon their pedestrian powers and patience. It should not escape remark, too, that the spot selected for the erection of this lofty burthen of earth is absolutely one of the very lowest in London, so that a great deal of its height would go for nothing, in consequence of the unfavourable nature of the ground. The same objection might, indeed, be urged against the Abbey, or rather might have been urged at the time the Saxon kings began to build it; but, as it is, the Abbey is *there*, already raised to a considerable elevation, and capable of supporting the additional weight of the spire it was always intended to receive, though it has somehow arrived at the 19th century without receiving it.

I have nothing further to add on this subject, except that to me the preferability of the Abbey spire to the Parliamentary tower does not appear a matter of dispute, or a mere question of taste, but a point which every body must inevitably decide in the same way who, having eyes in his head, places himself at the Parliament end of Parliament-street and makes use of them.

With respect to the ground-plan of Mr. Barry's buildings, a single glance is sufficient to show that it is *Gothic* enough. The many-shaped and manifold little court-yards which it presents, distinguish it at once from every other building of the last two hundred years. In fact, one can hardly persuade oneself that an edifice in which it has been thought so necessary to draw a careful distinction between an entrance for lay and an entrance for spiritual peers, can be the production of so unhallowed an era as our own. The two largest rooms in the whole of the immense pile of building appear to be, No. 18, "The Lords' Libraries," and No. 37, "The Commons' Libraries." How are they to be composed? If one contains works not to be found in the other, an occasion may arise in which, spite of the wall of separation between them, a commoner may consult a lord's edition of Shakspeare, or a lord a commoner's copy of Gibbon, and thus the evil of "promiscuous reading" be incurred. Or are they, to guard against this, to consist entirely of duplicates? Two extensive libraries on this plan under the same roof would be rather a novelty in the history of such establishments. One is really almost tempted to ask the question, whether any material injury would result to the State if these two libraries were thrown into one?

This plan also shows us, that it is not intended that New Palace Yard shall, as was expected, be open to the river so as to command a view of the bridge. The old Star-chamber buildings, recently destroyed, are to be replaced by a new clock-tower, a "Residence for the Serjeant-at-Arms," a "Deputy Housekeeper's Residence," and what not, which will answer the purpose deemed, it appears, desirable by Mr. Barry, of preventing a view of Westminster Hall from the bridge. As the terrace *to be constructed along the bank of the river is only* to be *open to the Speaker and the Members of* both Houses, the public will thus be as completely shut out from the Thames as at Somerset House. Like Sir William Chambers, Mr. Barry seems to have no idea that any architectural use can possibly be made of a river 1,400 feet wide, flowing close to the walls of his building. Yet, surely, if there is one object in nature that combines more beautifully with an object of art than another, it is that of a majestic river seen through a lofty arch. This would be well exemplified if the solid middle of the river-front of Somerset House should ever be removed, and an open line of arches, like that of the entrance into the great court-yard from the Strand, put in its place. The passenger along the Strand would then enjoy a view of the river under the double line in more majestic circumstances than it ever appears elsewhere. If, by a fortunate impulse of good taste, the Benchers of the Temple should, amid the numerous alterations and new buildings they are carrying on there, substitute a straight street leading from Fleet-street to their gardens, in place of the miserably narrow and crooked ways of access with which they are now content, and make the entrance as now under an arch of respectable dimensions, this would afford a scene of rival excellence. But in spite of all the talk about quays that we have heard of late years, the powers that be seem determined to go on considering the Thames as nothing but a great common river, to be kept out of sight as much as possible.

Having thus satisfactorily erected myself into an arbiter of architectural taste and a censor-general of metropolitan improvements, I cannot in that capacity avoid saying a few words on some of the rather extensive alterations now going on in the City. Unluckily, extensive as they are, they are not quite extensive enough. There seems to be a fatal propensity among the leading men in that quarter to "spoil the ship," as the proverb runs, "for a ha'porth of tar." There could not well be a more striking illustration of this proverb in fact than has recently been afforded by the various circumstances connected with the erection of the Adelaide Hotel, at the foot of London Bridge. The spot of ground on which it is built ought not to have been built upon at all. It was just about large enough to form an admirable quay,

with the river on one side, part of the bridge on another, St. Magnus Church on a third, and Thames-street on the fourth, where, if built at all, the hotel ought to have been placed. This area, handsomely paved and ornamented, with a statue in the centre, would have formed a little square altogether unique—the more especially as when viewed from the bridge, the Monument, seen from the pedestal at the bottom to the phœnix at the top, would have formed part of the picture. The Monument, in fact, "showed off" much better when seen from this point than from any where else, as every one must have remarked who crossed the bridge before this view was so effectually destroyed. The hotel, however, was built, and that was bad enough—but it need not have been half so bad as it is. Who would have thought, till convinced by actual "autopsy," that the buildings would have been allowed to be carried so far to the east as to intercept the view of the river and bridge from Fish-street-hill? Not only, however, was this unpardonable act of Bœotianism committed, but, to make bad worse, this side of the hotel buildings is, on the true ship-spoiling principle, carried up much in the style of a factory, in strong contrast to all the rest; and the view of the church, either from Fish-street-hill or from the river, where it is seen by thousands in the boats and steamers, is the very climax of shabbiness. The whole affair is vexatious in the extreme. A happy opportunity has been converted into a downright misfortune.

I hope we shall not have to deplore some similar instance of perverse ingenuity in the new street now making from Lothbury to the City-road; but it is impossible to look at it without having one's doubts. Coming from Finsbury-square, one perceives at the right-hand corner of London Wall a house still standing which ought, assuredly, to come down. It projects two or three feet into the line which would be formed if the new street were carried on as wide as Moorgate; but as the new street is apparently to be of two or three feet less width, there is reason to fear that the City improvers, not having the necessity of rounding a corner before their eyes, will *allow this house to stand, in which case it will, assuredly, form a very striking defacement of the new buildings*, and the diminished width, thus abruptly forced on the attention, will be ten times as conspicuous as it need be. This would be another illustration of the propensity to "spoil the ship." Perhaps with the great expenses already incurred in this great undertaking, which, as a whole, does the highest credit to the taste and spirit of the City, it would be unreasonable to call for much more, yet one can hardly help wishing that a way may be found of clearing away those unsightly warehouses which, at present, are all that present themselves to the eye in Lothbury, in coming along Prince's-street from the Mansion House, till, by a sudden turn, the new street bursts at once upon the view. Perhaps it will be alleged that this contrast enhances the effect; but be that as it may, if by the removal of these warehouses a way were opened through into Coleman-street, so as to afford the passenger a choice of two roads from the City, and if the point of divergence were adorned with a statue, or fountain, or obelisk, to correspond with the fountain which, it is said, is intended to ornament the other end of Prince's-street—an act of justice, and nothing more, would, it appears to me, be rendered to the inhabitants and proprietors of Coleman-street, and the City improvements would have to boast of a point of splendour superior even to any in their Government-patronised west-end rivals.

But these apprehensions of half-and-half measures with regard to the new street sink into insignificance when compared with those, which circumstances appear to confirm, with respect to the improvement now carrying on at the end of St. Martin's-le-Grand. Ever since St. Paul's has been built, a regret has been constantly and generally expressed, that it should remain so blocked in and pent up as it is by houses. Ever since the New Post-office has been finished, it has been obvious that one of the best methods of in part remedying this, would be to continue St. Martin's-le-Grand straight into St. Paul's Churchyard, by which a splendid view would be opened of the very magnificent building of Sir Christopher Wren in conjunction with the very large one of Sir Robert Smirke. The mere clearing away of the houses which form the objection would at once produce a square of two

passing beauty, appropriately terminating the most crowded street in London by a spot of perpetual vivacity and truly metropolitan magnificence. The side of the square fronting Cheapside would present an excellent site for splendid shops, or an important public building; its centre, so near the centre of London, close to the Post-office and St. Paul's, would be the very place in which to set up the "Great Metropolitan Milestone," if ever one should be established, for all distances to be measured from. Such are the improvements that might be made on this spot—that *must* be made, if the alterations are to be called improvements at all. But what are those actually in progress? The houses which fronted Cheapside are in course of demolition, but the destruction does not extend sufficiently far behind to open the view for the width of St. Martin's-le-Grand; and part of the ground which is now vacant is to be destined to remain so only for a time, and then to be covered again with houses built only a little in the rear of their former site. If new houses actually are created in place of the old ones, and there seems every likelihood of their being so, the whole affair will absolutely be not an improvement, but a deterioration. Nothing, however, is too bad to suppose of the plan when we find that it is intended to leave the houses between Paternoster-row and the Church-yard untouched. This, indeed, can do no harm. If the other space were only cleared, it might safely be left to "human nature" to see how long that great row of houses would be tolerated between the eye of London and St. Paul's. But if an accursed mob of chimneys (pardon the unavoidable warmth of language on an occasion like this) be still to send up their smoke between St. Martin's-le-Grand and the Row, I can only invoke the deepest vengeance of all the gods of Architecture on the heads of those self-styled improvers, who, by commencing the demolitions in this quarter, have "raised the word of promise to the ear," but so woefully "break it to the hope."

That these apprehensions may end in an "agreeable disappointment" is the earnest wish of, yours, &c.

P. P. C. R.

May 23, 1836.

P. S.—There are a few errors of the press in my last letter in your Number for May 7. Page 77, col. 1, line 18 from bottom, for "any where" read "any where else;" same page, col. 2, line 7 from bottom, for "to mention" read "for domestic". Page 78, col. 1, line 18, for "irregular apathy" read "singular apathy." The other errors are not worth noticing.

LADIES' LIFE-PRESERVER.

Sir,—I beg to call the attention of the water-excursioning part of the public in particular, and to others in general, to an excellent, and, at the same time, handsome marine life-preserver for ladies. I propose that, in lieu of having ladies boas stuffed (as they now are) with wool or cotton, &c., that a tube be made of Macintosh's water and air-proof cloth, of such size, that when inflated and covered with fur, it should have the appearance of a common stuffed boa. This would support any person, however large or stout, in the water; would not detract from the beauty of the boa, and what (though of trivial consequence to some) is important, would not have that appearance of fearful care, so much disliked by many that would otherwise always carry an air-belt.

Some people may object to carrying a boa with them in summer. To them let me recommend, that instead of having their French sleeves puffed out with cane, or down, they should have them lined, as it were, with bags (of the requisite shape) made of some of Macintosh's finest and lightest air-proof cloth; these being attached to the arm, will support the head entirely out of the water; of course they must have a small tube attached to them for inflation, and as the smallest possible size would be the best, I will, in the course of next week, send you a drawing and description of one that I have planned for the purpose.

The air-proof lining can be made for ten or twelve shillings, according to the size.

Hoping the above may prove the means of saving lives, or, at any rate, of giving confidence to those who are fond of the pleasure, but do not like the danger of water-parties. I subscribe myself,

Your humble servant,

CAMPO-BELLO.

CORNISH STEAM-ENGINE WORK.

Sir,—I have noticed in several Numbers of your Magazine such wonderful stories of steam-engine work, that at first I set them down as of American origin, but from a passage in No. 661, I see that they are from no further off than Cornwall, which is called "*the* nursery of steam-engines," and that "all the world knows it!" If the article *a* had been applied to *nursery* in place of *the*, it would have been perhaps more just to some of your readers, for people in other parts of the kingdom besides Cornwall have been endeavouring to improve the steam-engine.

It is truly said, "that the vast quantity of water to be raised from the valuable mines in Cornwall, prompted and rewarded the exertions of Savary, Newcomen, and Watt," so also Trevethick, Woolf, and others, followed; and it appears that the latter nearly as much exceeded Watt, as Watt did Newcomen. It is generally admitted, that the best of Watt's engines could raise at the rate of thirty-two millions of pounds one foot high, with one bushel of coal; this, I presume, is equal to one million thirty-two feet high (which some think is a more useful shape in which to state the rate); and it is said, that Mr. Woolf was the first to raise so much as fifty millions. If Trevethick had used his high-pressure steam expansively, according to Hornblower, and condensed it according to Watt, there would not have been much left for others to do; but this combination was left to be achieved by Mr. Woolf, whose exertions I hope will be amply rewarded.

Now, Mr. Editor, as far as fifty millions, and a little farther, I am inclined to believe from my own experience, but I must protest against such a statement, as that eighty, one hundred, and one hundred and twenty-five millions of pounds have been raised one foot high with the consumption of one bushel of coal, until it is described more particularly how such a conclusion was arrived at in place of the common answer by *calculation*.

It is no wonder these statements have been doubted, and I (as one of a few) am prompted to thus express my doubts, because it is stated that the increase is owing to the improved pit-work, and the system of clothing or casing the cylinders. I am glad the Cornish engineers have given the cause of the great increase, and that it has been accomplished by such simple means. With regard to the pit-work, I am informed by several parties who well know what is going on in Cornwall, that very little improvement has been made in that respect for forty years past, and certainly none for these last twenty-five years. It is well known how difficult it is to make a pump (be it ever so mathematically constructed,) to deliver a quantity of water at a great height to agree with the *calculation* or the measurement of that part of the pump *supposed* to be filled and emptied every stroke. Any admixture of air, or obstruction in the suction, or ascension, or any other imperfection, will produce a variation from the calculation; and the deception will be nearly the same, whether buckets or plungers are used. Perhaps some imperfection in the pump-work has led some of the reporters to make an alteration in their figures, for I have known engines to work very regularly as to their number of strokes per minute, when it was afterwards found that the pumps had not delivered their proper quantity of water.

As it may be said I have been finding fault without pointing out any remedy, or mode of doing away with the objections, allow me to say, such statements as I have referred to (which amount to doing four times the work with the same quantity of fuel as the best of Watt's engines), will never be generally believed until a well-authenticated performance is published of a certain quantity of water having been actually lifted and delivered at least one hundred feet, yards, or fathoms, above its natural level with the consumption of a certain quantity of fuel. This can easily be given in gallons or cubic feet; the account to be kept for one month, as is usual in Cornwall. There can be no want of opportunities in that district to do this. I therefore hope that, in a national point of view, it will be done, especially if Cornwall wishes to keep foremost in steam-engine work. As to the system of clothing or casing the steam-vessels, &c., from which they say so much benefit has been derived, I had thought that the people in the north-east were pretty well up to *jacketing;* however, we will all be glad to be set right on this point! if, therefore, the Cornish engineers will prove that they can grind four bushels of wheat into good flour,

with the consumption of the same quantity of fuel as the best Watt's engine requires to grind one bushel, or to do any other kind of work in the same proportion, they may depend upon plenty of profitable employment, and I, as well as many others, will be happy to witness it.

Your obedient servant,

JONATHAN DICKSON, Engineer.

9, Charlotte-st, Blackfriars-road, May 25, 1836.

THE LATE ECLIPSE OF THE SUN.

Sir,—The late eclipse of the sun, which occurred on Sunday the 15th of May, was one of the most beautiful celestial phenomena which has been observed for many years past. In the north of England, and of Ireland, and in the south of Scotland, it was central and annular; that is, the disk of the moon passed over the diameter of the disk of the sun in a line which coincided with the line of observation, or of sight, from those parts. The average time of the commencement of the eclipse in those places, was about 11h. 7m. morning; the annular phase commenced at 48m. past 12, noon, the middle or centre when the disk of the moon centred with that of the sun, and left a ring of light in breadth of about one-sixteenth of the sun's diameter, occurred at 2h. 21m.; the annular phase ended at 3h. 45m., and the eclipse itself ended at 4h. 56m. The moon, therefore, in those parts appeared nearly stationary in respect of the sun's disk, for upwards of one to three hours, and afforded a most gratifying period of observation upon this interesting annular exhibition.

During the time of the central eclipse, its appearance, taking the diameter of the apparent disk of the sun as equal to 1, was

At Edinburgh the eclipse commenced at 1h. 33m., its middle 2h. 59m., and its end 4h. 19m. The annular appearance there lasted only about 15m. At Greenwich the eclipse began at 1h. 51m., its middle was at 3h. 19m., and its end at 4h. 39m. About London the day was extremely favourable for observations; the sky was unclouded, and the air clear; owing to these circumstances, the darkness at the middle of the eclipse was not so great as had been generally anticipated. The magnitude of the eclipse in these parts, the sun's diameter, or apparent disk, being taken at 1, was at the middle = 0·863 upon the northern limb, that is, nearly equal to nine-tenths of the sun's disk; but the eclipse not being annular in these parts, the light of the uneclipsed portion of the sun was stronger than it was in those places in which the eclipse had an annular appearance. Near London, the centre of the moon passed the line of observation above the centre of the sun about ·12 of its diameter, at an angle of elevation with the horizon of about 35°.

The following diagrams exhibit three appearances of the eclipse at the times indicated to each, from observations made about four miles south of London.

2h. 30m. 3h. 20m. 4h. 15m.

eclipsed—·333. middle—·863. ·325·

It may be observed, that the eclipse increased from its commencement more rapidly than it went off; so that the disks did not present the same relative appear-

ances upon the opposite limbs of the eclipsed part of the sun.

J. L. S.

SIDERIAL AND TROPICAL PERIODS OF THE MOON.

Sir,—In the *Library of Useful Knowledge*, article Astronomy, part 3, pp. 68 and 69, regarding the siderial period of the moon's apogee, it is stated to be 3,232d. 13h. 56m. 16·8 sec.; and for the siderial period of the moon's nodes, 6,793d. 10h. 6m. 29·952 sec. Now I would feel greatly obliged were you, or any of your astronomical correspondents, to be informed why the siderial period of the apogee is longer than its tropical period, and why the tropical period of the nodes is longer than the siderial period; for, in some works, I find 3,231d. 11h. 57m. to be the tropical period of the apogee, and about 6,798d. 6h. 20m. the tropical period of the nodes? If the periods given by the *Library of Useful Knowledge* be correct, how are their tropical periods found?

By giving an early place to this, you will oblige your old and constant reader,

ROBERT SIMPSON.

THE RAILWAY SYSTEM.

Sir,—Just in the midst of the prevailing railway "excitement," it sounded very strangely to English ears that the French Minister of Finance should have adduced, as a reason for continuing the present prohibitory duties on foreign coals and iron, the "fact" (as he called it), that most of the already-existing railroads in England had turned out complete failures, in a pecuniary point of view. It must certainly be allowed, that this assertion was a little too broad; but the Frenchman's view of the matter can hardly be more absurd in one direction, than the ideas of thousands at home must be in the other. Nothing further seems to be necessary now-a-days to procure subscribers to a railway scheme, than to form the project of establishing a line from one town to another, "not already in possession of this improved method of communication"—no matter what may be the extent, population, trade, or manufacturing and commercial importance, of either. It is taken for granted, that as soon as the railway is completed, the traffic necessary to pay an enormous per centage on the capital will follow as a matter of course. Yet what says the little experience we have yet had on the subject? For what reason is it that the Hogs'-Norton and Dreary Common Railway has only to issue its prospectus to secure a snug premium for its shares in the market? Simply this, that a railway between Liverpool and Manchester, two towns of immense population, at a distance of little more than 30 miles, one the commercial, and the other the manufacturing capital of the great "northern line" of England—has succeeded to such an extent, that (aided by the attraction of its novelty, which draws passengers to it not only from all parts of Great Britain, but of the Continent,) it pays the shareholders between 9 and 10 per cent. on their capital.*

And this amazing result has been sufficient to transform us all into a nation of speculators! Encouraged by this dazzlingly brilliant success, having this proof positive before us that a line of railway in perhaps the most advantageous situation that could possibly be selected, will actually yield a *something* over and above its expenses, we are ready at the first blush to yield assent to the very reasonable proposition, that every peddling market-town ought forthwith to be accommodated with a road, costing the trifling sum of 30,000*l.* a mile!† If the Liverpool and Manchester has paid 100 per cent. instead of 10, the rage for railways could hardly have been greater than it is at present. "Can these things be, and overcome us like a summer cloud, without our special wonder?"

Some of the lines projected, and the grounds on which they rest their pre-

* We do not think this is by any means a fair view of the case. The Liverpool and Manchester Railway is by no means the only one which has furnished an example of great success to stimulate and justify the prevailing fondness for railway speculations. The Stockton and Darlington has paid still better than the Liverpool and Manchester, and is the older line of the two, (can it be that our intelligent correspondent has never heard of it?) the Edinburgh and Dalkeith, and the Dublin and Kingstown, are also yielding handsome returns to their respective proprietors. It deserves further to be observed, that the dividends of the Liverpool and Manchester Railway Company are *limited* by their Act of Parliament to 10 per cent. (a limitation introduced through the influence, and for the protection, of certain canal-owners): and that but for this circumstance, they might be a great deal higher than they are. The limitation of the dividends has the natural effect of keeping up the rates of conveyance, and these again of restricting the amount of traffic.—ED. M. M.

† This is the maximum rate. In many cases the expense does not amount to 10,000*l.* a mile; in some it is as low as 6,000*l.* and 7,000*l.*—ED. M. M.

tensions to support, are so ridiculously absurd, as to afford infinite amusement to any one not bitten with the railway-tarantula. There is one, the "South End and Hole-Haven" (magnificent in sound, at any rate), which proposes to throw off branches to "Tilbury Fort, Mucking, and other trading places on the line!" What can sound more feasible than this, and what dreamer of railway-riches would be so foolish as to dispel the illusion by referring to the matter-of-fact authorities, who tell us that Tilbury Fort is a mere barrack for a company or two of soldiers, and Mucking a village with nothing remarkable about it, and containing nearly 200 inhabitants, with one public-house for its only "trading" establishment? *Such is the fact*, and doubtless many more such glaring instances of wholesale misrepresentation might be produced by any one who would devote the time and patience necessary to the examination of the ponderous mass of railway prospectuses which have crowded the columns of the newspapers for the last few months. He who should do so, and publish the results of his labours, would be a great public benefactor; but it can hardly be expected that the cause of Truth should find a champion stout enough to put to the rout the thousand champions of the cause of *something else*, who are every day being called into existence by that most powerful of motives, self-interest.

It is not a little singular that the public are offered the choice of three very different species of railway to Blackwall—in the air, on the earth, and under ground. The first is Sir John Rennie's, similar to that of the Greenwich Railway, to be supported on arches; the second, the northern line, to run as nearly as practicable on the surface; and the third, and most eccentric, the pneumatic, which *is to be* a subterranean tunnel all the way. This latter is not projected by the redoubtable Mr. Pinkus, but by Mr. Vallance, the original promulgator of the idea, who was to have finished a railway on that principle to Brighton by this time, if he could have raised the necessary capital. Poor Mr. Pinkus appears to be in the back-ground altogether.

Amidst the railway-rage, which for some time seemed quite to have annihilated common-road locomotives, several schemes have at length appeared for the introduction of *that* method of superseding horse-flesh. The "London and Holyhead Steam-Coach and Road Company" has indeed fairly given up the ghost, notwithstanding the efforts of its parents, Messrs. Macneil, Alexander Gordon, and Co. to keep it alive. In its place, however, have sprung up two new Companies, each of which only requires "the necessary pecuniary supplies" to drive all horses off the road at once. One of these rejoices in having secured the services, as engineer, of a Mr. Fraser, who rests all his claims to success on his discovery of the impracticability of the attempt to unite lightness with power in road steam-carriages; and, accordingly, proposes to smoke along at a dozen miles an hour in vehicles of a ponderosity far exceeding that of the broadest-wheeled waggon that ever crawled along at the rate of 14 miles in 15 hours! We do not find that Mr. Fraser has yet launched one of these wonder-working masses, and until he has, perhaps he had better leave the field to engineers of more experience—Mr. Hancock, for instance, who has taken the road again with great gallantry, and certainly with a greater improvement in point of speed. Were the question of expenses only solved, so that the carefully-guarded secret as to the extent of wear-and-tear might be safely made known, to all appearance Mr. Hancock would have nothing but plain sailing before him, but "there's the rub."

In point of cheapness, steaming by land can hardly ever equal steaming by water. We cannot expect, either on common road or railway, to be conveyed to Hull for two shillings—the present fare by sea (a distance of at least 300 miles); nor, even if the suspension-bridge across the British Channel were fairly erected, could the journey to Boulogne well be effected for less than five shillings, the present rate per steamer. Notwithstanding this, I believe it seldom happens that a railway projector does not calculate upon securing every particle of traffic on his line, to the exclusion of every other mode of transit. The possibility of competition as an element, that never enters into the composition of a railway prospectus; the fortunate shareholders of the concern whose glorious prospects are being held out to view, are always to *engross* the whole trade, not only of their own line, but of all the

neighbouring country, although perhaps at the same time half-a-dozen other rail-roads are projected in the immediate vicinity.

Trusting that these few random remarks, if admitted to the pages of the *Mechanics' Magazine*, will not be without some little utility.

I remain, Sir,
Yours most respectfully,
H.

London, May 20, 1836.

ELECTRO-VEGETATION.

Letter V.

Sir,—The uses of soils with respect to vegetation appear to be threefold; 1st, to afford a firm and erect standing to the plants, by allowing their roots at once to spread through and to obtain a sufficient holding for this purpose; 2nd, to administer moisture to them in such quantities as are requisite to serve as the medium of maintaining their vitality, and of furnishing them with nutriment; and 3rd, to yield certain extracts in a state of solution in the water, which conduce to the sustenance and peculiar properties of plants. From many experiments and facts, well known with respect to the continued fertility of certain soils, consisting of the three principal earths, chalk, clay, and sand, duly admixed and combined, it appears probable that a very small proportion of earthy matters enters into the substance of plants, and consequently that water and carbonic acid are the principal materials which conduce to their nutrition; the carbonic acid and a portion of the water undergoing a decomposition within them, by the action of light in connexion with their organic structure and chemical properties. It is a curious and interesting question how far plants are indebted to the water, the carbonic acid, and other extracts from the soil, for their growth, verdure, &c., and in what degree they owe them to the functions of the leaves and stem upon the air, vapours, and light of the atmosphere. This last appears best adapted for acting electrically upon them through each of those elements, in the several ways we have described; while the soil is evidently essential for the several purposes above-mentioned, especially the two former. The earth appears nearly alike useful to plants by administering moisture to their roots, and by yielding exhalations to the atmosphere. It seems to have been well ascertained that carbonaceous matter in the soil is highly conducive to their growth and luxuriance, and yet it is much more evident that carbon is furnished to the leaves from at least an *aqueous* atmosphere impregnated with it, than that it is imparted to them from beneath by means of the roots and stem. In proof of this I inserted the stem of a sprig of spearment in water, impregnated with carbonic acid, sufficiently to produce a copious production of oxygen by the action of the leaves; while its upper part was immersed in an atmosphere of water, from which the air had been expelled. Very few globules now issued from the leaves; but on reversing the waters, the leaves being placed in the impregnated water, drew from it copious globules of oxygen. And here it may be observed, that minute but numerous globules of gas settled on their upper surfaces, while large globules were issuing from beneath, the former probably consisting of carbonic acid, which, in passing through them, deposited its carbon and was converted into oxygen.

An experiment, however, made early in the month of November, when the leaves are assuming their autumnal hue, and rapidly disappearing, seemed altogether favourable to the conclusion, that the stem draws up carbonic acid with the water, and diffuses it over the leaf. On the 2nd inst., leaves of the vine, green, fading, and yellow, had their strigs inserted in water impregnated with the aerial acid; and corresponding ones in unimpregnated water; all the leaves being alike exposed to the action of the air and sun. On the 5th the *green* leaves of the impregnated water retained their greenness and vigour, while the leaves of the unimpregnated water were nearly seared. On the 13th the former had assumed a reddish hue, and in this state dropped off, while the latter were quite withered, but adhered to the stem. Now M. Macaire, having observed the respective effects of acids and alkalies on what he terms the *chromule* of the leaf, the one in imparting to it a red or yellow, and the other a green colour, drew the general conclusion that "the resin of the leaves which have undergone an autumnal colouring, seems to be nothing but green resin oxygenated, or having undergone

a sort of acidification." To what is this acidification of the leaf in the autumnal season owing, but to the diminished action of the solar rays, in consequence of which a portion of the carbonic acid remaining undecomposed within them produces this change in their colour; but from the above simple experiment, it appears to be drawn up and diffused over their surface through the stem, together with the water, and thus it seems to occasion also the *drop* of the leaves, while it is probably instrumental in preserving some degree of vitality in the plants, instead of suffering them absolutely to wither and perish during the winter season. So far as any inferences can be deduced from these minute, single experiments, it would appear that carbonic acid is conveyed to the leaves, both through the stems from the sap, and from the moisture of the atmosphere, the larger portion coming from the latter source when opportunities are afforded by the presence of moisture thus impregnated in it, or, perhaps, also by dry carbonic acid floating in the air; but such inquiries require to be more extensively pursued before we can arrive at certain and correct conclusions.

As much *hydrogen* enters into the substance of plants, and, from various experiments, it appears to unite with carbon in producing the green colour of the leaf, it must either be obtained internally from the sap, or from the atmosphere, by an action of the leaves. This is in general probably accompanied with the decomposition of water, to which process it is likely that there is a similar necessity for the agency of light, as in the case of carbonic acid. We are not aware that in the ordinary course of nature hydrogen, in a state of separation from oxygen in the form of water, is ever presented to the leaves. But when they are by artificial means, or by some extraordinary concurrence of circumstances, exposed to such an atmosphere, the effects are remarkable. I have repeatedly observed that sprigs of spearment not only live equally well in it as in common air, but that their verdure is heightened; and for one or two days after being introduced to it, their ordinary transpiration of moisture has been almost wholly suspended! M. Humboldt informs us, that he met with green plants growing in complete darkness at the bottom of one of the mines of Friesburg, in which hydrogen gas abounded; and Dr. Priestley gives the following interesting account of several experiments with the willow plant growing in "inflammable air" obtained from a marsh—probably carburetted hydrogen:—"I put the stalk of a willow plant into an inverted jar full of water, while the top of it was in a jar of inflammable air. In these circumstances a small quantity of air was collected in the inverted jar, and it was evidently better than common air." In another experiment three-fourths of an ounce measure of very pure oxygen was collected under the same circumstances. "A sign of the great vigour of the plants growing in inflammable air was the vivid greenness not only of the leaves that were in the air, but of those also that were under water, and the length of time that they continued in those circumstances; whereas, in general, when the plant was in common air, the leaves that were under water soon became discoloured and perished. These leaves, on the contrary, not only continued green, but were always loaded with air-bubbles." In some experiments on water impregnated with carbonic acid, the doctor observed an abundant growth of green vegetation, while water unimpregnated with this gas yielded no such result. From these facts and experiments compared together it appears evident that carbon and hydrogen combine in producing the substance and the verdure of the leaves. In the ordinary course of nature the hydrogen is probably obtained by a decomposition of water; but in those cases in which it is presented to the plants in a state of separation from oxygen, the union of carbon and hydrogen appears to proceed with extraordinary facility. As the case related by M. Humboldt is perhaps the only instance in which green leaves have been observed growing in darkness, we have reason to conclude that light is the ordinary instrument by which hydrogen, as well as carbon, is separated from its oxygen; but as in that case there appears to have been no instrument, excepting the *caloric* of the hydrogen to supply its place, are we not necessarily led to the inference that they are, in this respect at least, identical? It seems highly probable that carbonic acid coming in contact with hydrogen gas in this mine, their tendency to union in the substance of the leaves became stronger than their affinity

to caloric in the gaseous state, which thus becoming disengaged, performed the function of light in promoting their union, and also in carrying forward the aqueous transpiration of the plants. Priestley's willow plants appear to have been under similar but more advantageous circumstances from the presence of carburetted-hydrogen; as in this case, light and caloric probably co-operated in forwarding the action of the plants upon the two elements of carbon and hydrogen, and producing the disengagement of the oxygen. What is the general inference to be deduced from the above premises? Is it not that the soil administers the due supplies of moisture in conjunction with such other materials as it holds in solution to the roots of plants, which, by the action of the solar fluid, chiefly under the form of light, are essential to their vitality and growth? And is not this effect, together with the decomposition of both carbonic acid and water by the action of the same fluid on their upper extremities, so much concurring evidence in favour of the electro-chemical agency of the same pure imponderable fluid in carrying forward the several processes of vegetation?

I remain, Sir,

Yours respectfully,

T. PINE.

Maidstone, May 23, 1836.

P. S.—In a letter received from Mr. Weekes on the 15th inst., he fully confirms my statement of "the necessary presence of carbonic acid in atmospheric air in order to the production of oxygen from the leaves of plants." He makes mention of some experiments which he has made on the presence of carbonic acid at different elevations in the atmosphere, which, I trust, he will communicate to the public on some future occasion, as they cannot but be highly interesting.

NEW MODE OF HEATING BOOKBINDERS' LETTERING-TOOLS.

Sir,—It is a well-known fact, that heat diffuses itself through metallic bodies with great rapidity; and this is exemplified when we plunge a piece of brass into melted lead, the former metal almost instantly attaining a degree of temperature equal to that of the latter.

This circumstance has induced me to conclude, that bookbinders' tools might be heated much more speedily, and with better effect, by dipping them into fused lead, or printers' type metal, or an alloy of lead and tin, than by exposing them, in the usual way, to a coke or charcoal fire. Sand floating on the surface of the fluid metal would, in a great degree, prevent the escape of its fumes, and also retard its combination with the oxygen of the atmosphere.

An experienced bookbinder, to whom I stated my views, expressed his belief, that the adoption of the plan would be found very advantageous in finishing-shops, where gilding forms so important a part of the business.

I remain, Sir,

Yours respectfully,

T. COGGAN.

Derby.

EFFECT OF THE VELOCITY OF AIR UPON ITS USE IN SMELTING IRON.

M. Teploff, one of the Russian Mining Corps, in an article on the improvements recently introduced into the smelting of iron in Russia, makes the following statement. In the smelting furnaces of the Ural, where the quantity and velocity of the blast are properly regulated, 1·4 of pig iron is obtained by 1 of charcoal fuel, while in other furnaces they obtain but ·4 and 6· by the same comsumption of fuel.

The velocity of the blast being increased, the heat within is increased, without a corresponding consumption of fuel. In an experiment made by order of the government, it was found that one hundred cubic feet of air, under a pressure of two inches of mercury, produced the same effect as two hundred cubic feet, under a pressure of one inch, with this difference, that, in the latter case, twice the fuel was consumed, which was required in the former case.

In one furnace which is mentioned, 22,000lbs. of iron were obtained in twenty-four hours, by 16,000lbs. of charcoal. Previous to the due regulation of the draught, they consumed twice this amount of fuel for the same yield of iron.

This economy is obtained by duly proportioning to each other the size of the blast pipe, and the pressure of the draught. The relation of these to each other, varies with the furnace.

M. Teploff asserts that the results thus obtained exceed those with the hot-air blast, but it does not appear that any comparisons have been made under his examination, and with the charcoal fuel.

To regulate the draught, it is recom-

mended to place two mercury or water-gauges, one near the blast-pipe, the other near the governor of the blowing-machine. By varying the pressure, and the diameter of the nozzle of the blast-pipe, making the latter smaller as the former is increased, and *vice versa*, the best proportion is to be ascertained.—*Annales des Mines*, vol. vii.

EDWARD TROUGHTON, ESQ., F.R.S., L. AND E., F.R.A.S. AND F.R.S.C.E.

The late Edward Troughton was born in a small village in Cumberland, in the year 1754, where he received merely a common education in the village-school. When seventeen years of age he came to London, and apprenticed himself to his brother John, a respectable mathematical instrument-maker, carrying on business at No. 136, Fleet-street; and when out of his time was taken into partnership, and ultimately succeeded to the business, and ever after continued to reside there; and it is not a little remarkable, that the same spot has been successively occupied by mathematical instrument-makers of celebrity for nearly 200 years; and here a Sutton, a Wright, a Cole, and a Troughton, laboured with unwearied zeal for the advancement of science. In a very short time after Mr. Troughton's arrival in the metropolis, he began to display that great originality of genius, which in the end made all scientific men look up to him for the means of prosecuting their pursuits with the fullest effect—for be it remembered, that the sublime study of astronomy must ever be obscure without instruments of the most accurate execution, because the theorems of mathematicians are useless without data to act on—and with this he supplied them; presenting to all competent persons the means of *dividing* instruments with the most perfect accuracy, and by which they have been graduated to such a degree of exactness, that error is not to be discovered in them even by high optical powers; and many of his instruments of large dimensions are placed in various observatories, and by them a catalogue of the fixed stars, and the sun, moon, and planets, are now ascertained, and published in the *Nautical Almanac*. Many other skilful artists have also acted upon his improvement. The stability, accuracy, and commodious arrangement of his instruments leave nothing for the astronomer but to use them with care, as it is a fact, that the *declination* of some of the fixed stars have been ascertained by them to one-third of a second. It is unnecessary to follow Mr. Troughton step by step, but a reference to a few of his great undertakings cannot be without interest. The Royal Observatory is furnished with a mural circle, a transit instrument, and a zenith sector, all of his contrivance; and the last was completed by him when in his 79th year: also, an equatorial instrument, for Trinity College, Dublin; and which is now stationed at Armagh: and a meridian circle (made for Stephen Groombridge, Esq.), now belonging to Sir James South; the whole of which are specimens not perhaps to be equalled either in beauty or figure, or perfect accuracy. He also remodelled the continental instruments so as to make the repeating circle of the Chevalier Borda, and the reflecting circle of Mayer, almost original inventions of his own. His nautical instruments, also, both as to construction and accuracy, are beyond all praise; and by them the mariner is now indeed enabled "to mark a road on the trackless ocean." Nor were his great labours wholly unrewarded; for the Royal Society, in 1809, presented him with the Copley Medal, for his elegant and valuable paper on Dividing. On the 7th of April, 1823, he received the freedom of the Clock Makers' Company; and in January, 1830, the King of Denmark presented him with a valuable gold medal, as an acknowledgment of his great and important improvements. In his latter years he devoted himself entirely to severe study and scientific pursuit; and laboured not merely in abstract theory, but for the improvement and direct benefit of the civilised world. Retaining his faculties to the last, he died on the 12th of June, 1835; and, according to his request, his remains were deposited in the General Cemetery, Kensall Green; and were followed by many, and deeply regretted by all the scientific world.—*New Monthly Magazine.*

NOTES AND NOTICES.

New Power.—We learn from Frankfort that there has been communicated to the Society of Natural Sciences of that city a discovery of a new motive power, created by means of a galvanic battery, the action of which will supersede the use of steam, be more powerful, much less expensive, and less dangerous.—*Morning Herald.*

National School of Design.—In the course of a discussion which arose in the House of Commons on Monday last upon the vote of 25 800*l.* for new buildings at the British Museum, the Chancellor of the Exchequer (Mr. Spring Rice) said, that he intended to lay before the House a supplementary estimate for the purpose of establishing a school of design, with a view generally to the cultivation of the popular taste, and to the practical improvement of our manufactures. He trusted that the proposed institution would be well suited to serve as a model according to which other schools might be formed in provincial places.

The Thames Tunnel.—This stupendous undertaking is proceeding slowly, but steadily towards completion; nor has any obstruction occurred since the works were re-opened. The men work night and day; there are three sets of men employed, which relieve each other every eight hours. Each set consists of 112 men, and there are numerous supernumeraries, ready to supply any casual vacancy. During the eight hours of work they are

allowed only a single half hour for refreshment, which is brought to them on the spot. The wages paid are high, as much as 40*s.* and 45*s.* per week, and hence the engineer is enabled to command the services of first-rate bricklayers. The men are not called upon to perform task work; all that is required is, that they keep steadily at work, and that the bricks be laid in a workmanlike manner. The cement furnished is of the very best quality, only about a barrel of fine sand being used to 100 barrels of cement. The concrete thus formed hardens very rapidly, and within two hours after any new work is completed, its solidity is put to a very severe test. The overseers go round with hammers of fourteen pounds weight, with which each separate brick is struck a hard below. If the cement yields so as to disclose the smallest fissure between the bricks, the workman is immediately called back to repair the defect, and is, besides, fined one shilling to the sick fund. If the brick shakes in its place on being struck, nothing but a special plea in excuse can save the workman from an immediate discharge. With every exertion, from its peculiar nature the work is unavoidably tedious and slow. It is considered a good piece of work when at the end of twenty-four hours the shield can be advanced nine inches. The shield contains thirty-six boxes, and the work is being simultaneously carried on in each, so that the pushing forward the shield can only take place when the work of the arch is perfected to the extent from the bases to the key-stone. It will sometimes happen that a whole day is occupied in the mere work of pushing forward the shield. The extent of archway perfected is above 620 feet, and what remains to be done is about 1,200 feet, but of this extent a large portion being beyond low water mark, and through a solid stratum of earth, can be carried forward without such extreme caution as at the present part of the work, through a loose sandy soil, and under the very centre of the bed of the stream, is indispensably necessary.—*Morning Chronicle.*

A New Light of the Age.—In the course of a recent lecture on the properties of caoutchouc, Dr. Birkbeck introduced to public notice a pair of candles made of that material, at his own suggestion. After many unsuccessful attempts, they were at length fairly lighted; and it is only justice to the worthy Doctor to say, that his invention is likely to prove of great importance, whenever it shall come to pass that candles which are very difficult to light, which burn badly and gutter immensely when they *are* lighted, and which pretty soon go out of their own accord, are considered a desideratum. Until then, those less expensive, but more appropriate articles—tallow and wax—are likely to remain in general use for the purposes of domestic illumination.—F. H.

Cheap Locomotion.—Such is the march of competition abroad, that (if we may put faith in coach-proprietors' advertisements) the whole fare by diligence from Boulogne to Paris is only nine shillings. If this were quite true, the journey from London to Paris throughout might be performed for no more than fourteen shillings, the fare per steamer to Boulogne being only five! The fact however is, we believe, that what with the regular fee of the French conducteur, and other extras, the trip can hardly be expected to cost much less than a sovereign, or *fully three farthings a mile!*—F. H.

A Hint.—Mr. Alderman Wood, by his recent accession of fortune, under the will of his namesake of Gloucester, enjoys a rare opportunity of immortalising his name. It is well known that the Alderman, some short time back, promulgated a plan for the general improvement of London, among other things, by throwing open Waterloo and Southwark Bridges toll-free to the public; erecting a new street from the Mansion House to Southwark Bridge; straightening the upper end of Holborn, so as to affect a direct junction with Oxford-street; and executing divers other plans of unquestionable utility. And all this, and more, the Alderman calculated (it is not known by what elaborate process) might be done at an outlay of only 800,000*l.*! By a turn of Fortune's wheel, the projector of these mighty alterations has this sum at his own disposal; and how could he more gloriously display his civic patriotism than by carrying into effect his magnificent ideas for changing the whole aspect of the metropolis over which he twice presided as Lord Mayor? It is to be feared, however, maugre his own estimate, that he would arrive at the bottom of his purse, some time before he had got to the end of his trifling undertaking.—F. H.

French Theory and English Practice.—It is not a little singular, that, while England is making so great a progress in the actual establishment of railways, the French have published a much larger number of works on their mathematical theory; although this is, perhaps, not by any means the first instance in which the same state of things has occurred. A Colonel de Pambour has just added to the rather long list of publications by his countrymen on the subject, a very elaborate book of calculations on railway theorems, in which he lays down his positions rather more dogmatically than his little experience (all apparently gained in England) seems to warrant. He has not, however, much to fear from his English competitors in the line, the principal of whom are Mr. Macneil, of "canal navigation" celebrity, and—John Herapath, Esq.!—F. H.

Truth stronger than Fiction.—It is a well-ascertained, but rather unaccountable fact, that, notwithstanding the amazing increase of late years in the manufacture of steel pens, there has not been the slightest falling off in the extent of the quill trade.—F. H.

Communications received from Mr. Tracey — Mr. Dickson — Mr. Barton — A Country Teacher.

Mr. Baddeley's satisfactory defence of Messrs. Mordan and Co. shall appear next week.

The communication referred to by P. P. has been received, and shall be attended to.

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C. E., is now published, price 6*d.* Also the Volume complete in boards, price 9*s.* 6*d.*

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted. Drawings of Machinery also executed by skilful assistants, on the shortest notice.

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CURTIS'S SAFETY-BREAK FOR RAILWAY-CARRIAGES.

Fig. 1.

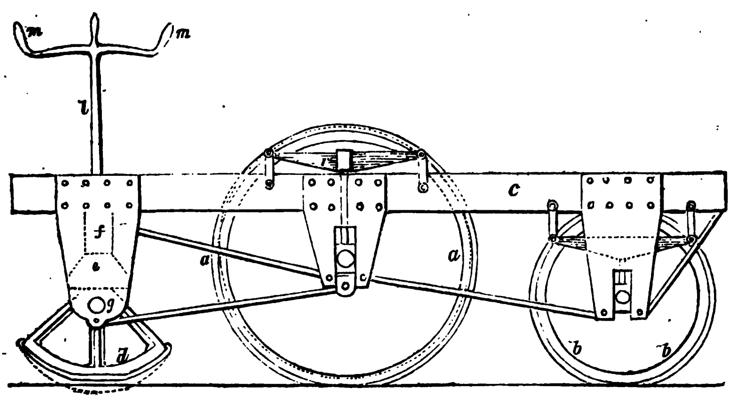
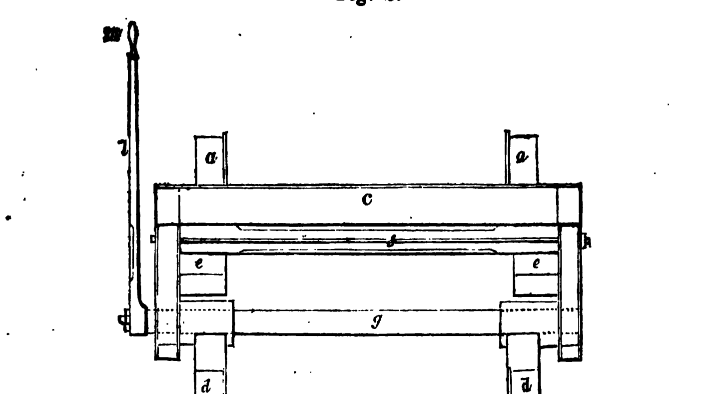


Fig. 2.



CURTIS'S SAFETY-BREAK FOR RAILWAY-CARRIAGES.

Sir,—I forward a drawing of my safety-break as applied to the engines of the London and Greenwich Railway, and shall feel much obliged by your publishing the same in your valuable miscellany for the public information. The leading features of this invention are its simplicity and effectiveness, producing a degree of resistance to the progress of the engine and train far greater than can be effected by any other brake at present in use; and, at the same time, no shock or jar is felt either by engine or train. These results are produced by a cycloidal cam placed behind the crank-wheels, which, when brought into contact with the rail by the lever *l*, lifts the wheels off the rail, when they assume the position shown by the dotted line, thus throwing them out of gear; the whole weight of the engine resting upon the crank-wheels are thus transferred to the cam (in the present instance, about seven tons), producing thus a degree of friction greater than can be obtained by any other force however applied. The lever *l* is only necessary to bring the cam into contact with the rail, as the momentum, of the engine turns the cam round until it reaches the stop *e*, when the distance lifted is about 1½ inches, as shown by the dotted line; then the wheel is off the rail 1-8th of an inch clear, the difference being taken up by the recoil of the springs *r*, the engine and train at the top of their speed have been pulled up within about 40 yards, and *without stopping the wheels;* so that for pumping water into the boiler, taking up passengers, avoiding accidents on the line, the crank-axle breaking, &c., the engineer is supplied with an important auxiliary.

Too much praise cannot be conceded to the enlightened management directing the interests of this undertaking, for the promptness with which my suggestions were at once taken up, in order that a degree of security might be assured to the public, which will render accidents upon this railway in future almost impossible.

Description of the Engravings.

Fig. 1 is a side, and fig. 2 an end view; *a*, crank-wheels; *b*, fore-wheels; *c*, engine-frame; *d*, cycloidal cam; *e*, stopper; *f*, beam, connecting the two standards of cam-shaft; *g*, shaft; *l*, lever fixed to shaft *g*; *m*, handles of lever; *r*, springs of crank-wheels.—Yours, &c.

W. J. CURTIS.

11, Grange-road, Bermondsey,
April 28, 1836.

HALE'S HYDRAULIC APPARATUS.

Sir,—A paragraph having appeared in a Morning Paper a few months since, eulogising the extraordinary ingenuity of a wonderful machine for producing motive power, which was patented, or about being patented, by a Mr. Hale, of Colchester. I naturally felt a desire, being curious in these matters, to become acquainted with the invention, which having accomplished, the result I will now briefly narrate.

The machine is composed of a horizontal cylinder closed at both ends, fluid-tight; through the centre of these ends project the shaft of a drum working in stuffings, which drum fills the chamber of the external cylinder all to about one quarter of an inch all round the ends of the said drum, working fluid-tight against the ends of the external cylinder; on the upper side of the drum, and between it, and the external cylinder, there is a stop which is also fluid-tight, being kept to the surface of the revolving drum by springs for that purpose; and on each side of this stop, there is an aperture in the external cylinder for the admission and emission of water. The action is shortly this: the chamber of one quarter of an inch in thickness, extending over the whole of the drum, excepting that part covered by the stop, is filled with water, which is termed *a fluid band;* this water, it is stated, is put in motion and caused to flow out through one of the apertures, whilst a supply is admitted by the other, either through the agency of a fall of water, a pump, or a fire, applied to one side of the external cylinder; and the power giving motion to the said drum, is also stated to be solely derived from the *friction* of the said fluid band passing round its external surface. It is unnecessary to offer any comment on this apparatus—but millwrights will, doubtless, immediately knock off the float-boards from all the water-wheels in the country as useless appendages!

Yours, &c.

ALAN MACKENZIE.

Oxford-street.

RAILWAY-BREAK AND BUFFER COMBINED.

Sir,—I beg leave to address you on the subject of buffers and the stopping of railroad-carriages. The accompanying drawings will show the improvements I propose, as compared with the methods at present in use.

Fig. 1.

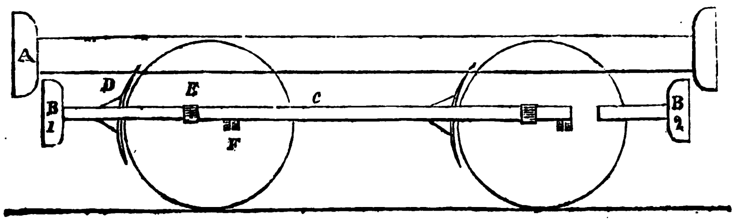


Fig. 2.

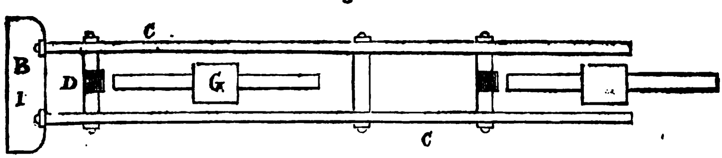


Fig. 1 is a side view of the wheels, &c. of a railroad-carriage; and A A represent buffers fixed, as is, I believe, usual on the ends of the lower framework of the coach bodies. Fig. 2 is a plan of my improvement. B 1 is a buffer, situate, as I propose, on the end of a frame of iron-work, C C C C, *in line with the axletrees;* D D are breaks fixed in this frame to press against the wheels when the buffer is struck; E E are sockets fixed to the axletree-blocks, or any where convenient, through which the side rods of the iron frame acts; and F F are stops by which the carriage is drawn. Now it will be seen, that when the buffer B 1 is struck, the breaks D D will close against the periphery of the wheels; and as all the carriages of a train are pressing upon each other, the application of the breaks would be instant and effective. B 2, at the hind end, is the drawing-buffer fixed firm to the carriage, independent of C C C C; and G G are the wheels of the carriage.

Fig. 3.

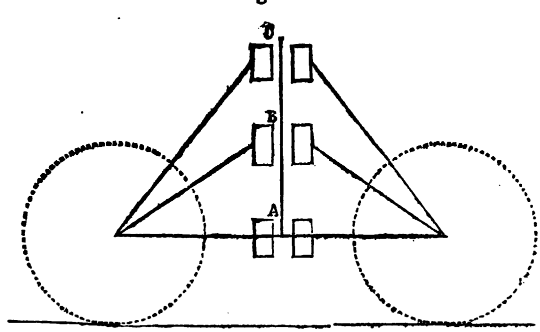


Fig. 3 is a theoretic view of the buffers as acted upon at different heights from the *line of the axletrees.* I will suppose B in this figure about the usual height of the buffers above the axletrees; C I have placed at an extreme, to show

the disadvantage of deviating from the line of the axletrees, A; now I can conceive, that when the buffers at C come in contact, the hind wheels of one carriage, and the fore wheels of the other, might be lifted from the rails. The same principle and proportionate tendency would be found at B, the *rebound* tending to raise each end of the carriages so struck throughout the whole train; and if such is the case, the present method must tend to increase the shaking of the carriages as well as to retard them; hence the great lapse before they can be brought to a stand. Now by the arrangement of the buffers and breaks I propose, the check to the wheels would be much more effective, and, to the passengers, I think, more agreeable; the frame-work of the carriages would be also considerably relieved from the destructive effects which must result from the present method; and, lastly, as every wheel would have a break against its periphery, a whole train of carriages would be brought to a stand in a third the space of distance they possibly can be by the present method.

I think the method which I have described is worthy of a trial, but as I have not any knowledge of persons likely to introduce it, your Magazine may be the means of putting it into practice.

I remain most respectfully, Sir,

Your very obliged servant,

G. MILLICHAP.

85, Aston-street, Birmingham,
May 11, 1836.

MACKINTOSH'S ELECTRICAL THEORY OF THE UNIVERSE.

"If the voice of the scientific world should pronounce it visionary and absurd, no one will smile with more complacency than the author himself."—*Vide Introduction.*

Sir,—As in my motto, so thought Whiston when he dispatched the comets, in his whimsical reveries, alternately from the hot region of the sun into the dark and chilled regions of far-off-space, carrying with them the perplexed spirits of the lost:—*he* "smiled" with equal "complacency" upon his own ingeniousness, and the verdict of the "world." So also smiled Dante at his purgatorial theorizing, and his visions of Limbo. So smiled, likewise, a more recent author at his own serio-comic speculations respecting the interior of the earth, in which he planted a race of beings, and an order of things fit for existing in a place devoid of an atmosphere, and of all fluids; but in which the "forked lightnings" played a part less harmonious, but not less effective or universal, than does the electricity of Mr. Mackintosh in *his* economy of the universal scene above.

Some years ago, when I was an infant (I am yet but a very youth) in such matters, I, like Mr. Mackintosh, conceived a vast notion of the powers of electricity. It was an all-efficient agent, invisible—delightful from its very mysteriousness. It was possessed of every quality that man could conceive to exist. It had the power of attracting, of repulsing, of compounding, and decomposing—of creating and exterminating; was the origin of light, of heat, of magnetism; had the first principle of life and motion, universally. It gave birth to vegetation; was the parent of all progression and of all changes, either in the inorganic or the organic world: it was perchance, the very essence of matter itself, as well as the author of its varied changes, and its varied forms. It sucked up the juices of the earth into heaven in peace, and threw them back in wrath, with all the havoc of angry and contending elements. It was alike the creator of the earthquake, the volcano, the tempest—or the fall of the gentlest shower, and the budding of the prettiest leaf. As it willed, it peppered the earth with hail, or sprinkled it with refreshing dew. It was procreative of all meteors—of falling stars; the aurora of phosphorescence—of all growth and all decay—of all rest and of all motion. It was omnipotent, omnipresent in things physical; the parent of all good and of all ill: in short, to express myself with precision, it was the wondrous originator of "both the larger operations exhibited in the motions of the planets, and the minuter processes of vegetation, oxidation, and vitrification!" All this, and much more, alas! was put into my head by a certain learned work, called a "Key to the Knowledge of Nature," written about twelve years ago by a Rev. Mr. Taylor, of Hart, in the county of Durham. It was a philosophical *excrescence*, and was touched with

actual cautery from the Royal Institution, beneath which it withered! It was *Brand*-ed, as may be witnessed by referring to their journal. Electricity here, as with Mr. Mackintosh, was a mighty philosopher's stone—a universal solvent—a panacea—a mighty governor, or an abject slave; its sphere of domination extending throughout all space—of servitude, as a maid of all-work, throughout all the heavens and the earth. To its capabilities there was no end! But experiment speedily relieved me of this mental disorder. Legitimate reasoning from things known and palpable, curbed my senseless imaginings. I was relieved from the grasp of an overgrown and senseless giant, and became myself again. Mr. Mackintosh treats us to as much as did Mr. Taylor; but, in the end, the mind sickens of such excesses. It is a revelry carried to inebriation, and corresponding collapse. The mind will close itself in future against all such mighty generalizations; and this period of sickliness, will be also a period of renovation. It is the faculties playing at *leap-frog* with reasoning undermost.

It would be easy, Mr. Editor, to show the illogical, as well as the unphilosophical spirit which pervades Mr. Mackintosh's papers. The whole might pass pleasingly for a whimsical speculation, or a philosophical reverie, but never for a sober exposition of a philosophic creed. The solar system, an immense electrifying machine! The sun its prime conductor! and the planets, (our unhappy earth among them) pieces of elder pith skipping between it and the nether negative region, at short intervals of millions of years! What an idea for an inheritor of mortality! and that Newton, too, should have "failed in not tracing the cause of motion to the all-pervading power of electricity!" But where is the battery—where the discharging rod—where the musical bells? Perhaps the charge is being collected in the rolling of ages, and will be spent in dissipating our globe as we now mimic the impending catastrophe by the Leyden jar and a bit of steel!

Let me invite some happy genius to set up an opposing theory, in which some huge entity plants his foot upon the firm footing of the sun, and plays at battledore and shuttlecock with the worlds about him!

Has it never occurred to Mr. Mackintosh, that where two theories, so conflicting as those of Franklin and Du Fay, can explain every phenomena of electricity, they must both be wrong? Some fortunate being is yet in reserve, like a second Newton, who will disentangle our minds from the prejudices derived from the contemplation of a past *imperfect* philosophy, which pervades (like Mr. Mackintosh's electricity, the universe) our present systems of philosophy. But it is surely unlikely that such a Herculean task will be accomplished in the "confusion worse confounded" of applying such an ill-digested science as that of electricity, to the ambitious project of explaining the varied economy of a whole universe. Would it not be more philosophic and admirable that such individuals as Mr. Mackintosh (talented and industrious as he evidently is), should devote themselves first to the establishing of certain and undisputed principles of electrical and galvanic action, which at present we possess not, rather than endeavour, without materials and without tools, to erect the stupendous theoretical edifice which he attempts?

Before concluding, I should wish, Mr. Editor, to ask you a question upon another topic. What has become of the decomposition of SULPHUR, announced in your journal some time ago? In the remoteness of such chances, has there no second thunder-storm passed over the city of Worcester, to enable our analyst to verify his first result? or was it a fallacy, an *incompetency*, or a hoax?

I beg leave, Mr. Editor, to add my testimony from this northern metropolis to the increasing value of your journal. Whilst you continue to make it the vehicle of such important documents as the Evidence of Accidents in Mines—the American Experiments on Explosions, as well as of original papers from so many intelligent correspondents as at present compose your list, it cannot fail to be held in deserved esteem.

I remain, Sir,

Your most obedient servant,

ZETA.

Edinburgh, June 1, 1836.

COMPARATIVE RAILWAY TABLE.

The different Amounts given credit for in this Table under the heads of Passengers, Tonnage, &c., are those which Committees of the House of Commons have reported to be verified to their satisfaction; or which, in the case of those Railways marked with an Asterisk, are authenticated by the Official Statements of their respective Companies.

NAME OF RAILWAY.	Capital.	Length of Line.	No. of Passengers per Annum.	Cattle.	Sheep, Lambs, and Pigs.	No. of Tons carried per Annum.	Nett Revenue.	Rate of Profit per Cent.
	£	Miles.					£	
Eastern Counties (from London to Chelmsford, Colchester, Ipswich, Norwich, and Yarmouth) . . .	1,600,000	126	2,174,000	60,763	453,333	360,690	352,909	22†
* London and Greenwich	400,000	3¾	1,803,000				80,000	20
———— Cambridge	1,200,000	53	1,178,216	111,956	533,520	72,214	174,422	14½
———— *Southampton . . .	1,000,000		765,856	7,775	6,375	23,949	207,485	20¾
———— Birmingham	2,500,000	112	684,001	41,600	364,000	47,546	369,346	14¾
North Midland	1,500,000	72	629,512			147,660	158,804	10½
South Eastern (London and Dover)	1,400,000	69	620,298	4,000	71,040	79,860	175,293	12
Great Western (from London to Bath and Bristol)	2,500,000	120	552,084	36,328	263,184	406,421	415,640	16
Midland Counties (Leicester and Rugby)	1,000,000	74 (including branches.)	466,000			198,000	104,420	10½
Manchester and Leeds	1,300,000	60	442,000			112,854	114,481	8¾
* Liverpool and Manchester . . .	1,024,375	30	396,161			208,172	68,608	10‡
Newcastle and North Shields . . .	120,000	6	335,800			166,829	14,914	12½
Thames Haven	450,000	15½	285,124			619,461	81,359	18
York and North Midland	370,000	24½	261,885	19,591	37,200	135,897	50,123	13½

† Exclusive of prospective traffic from the re-establishment of Yarmouth and Harwich as packet stations. ‡ By Act of Parliament the dividends of this Company are limited to 10 per cent.

RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal*, for March.)

MACHINE FOR SPLITTING SHOE PEGS, *Mark Wilder, Peterborough, New Hampshire.*—A vertical frame has, at its lower end, a cutting-knife for cutting the pegs, which knife is attached to a vertical slide, that is operated upon by a toggle-joint, worked by a bar, or pitman, in the usual way. The blocks, after having been pointed by a grooving-tool, are placed upon a sliding-bed below the knife, where they are secured upon a metallic disk adapted to receive them. The sliding-bed is made to advance by the action of a feed-rod, which receives its motion from that of the toggle-joint and slide. The grooved block must, of course, be adjusted to the knife, and must also be surrounded by a strap to keep the rived parts together.

The claim is, to "the toggle-joint, lever, and knife-shaft, the revolving-disk, and appendages, together with the palls by which the feeding is effected, the whole operating in combination for the purposes, and in the manner herein set forth and described."

The claiming of the toggle-joint, palls, &c., separately, is not a safe course, as they are not the invention of the patentee; yet, by a fair construction of the foregoing, they are claimed individually as well as in combination.

MACHINERY TO FACILITATE EVAPORATION, *John Goulding, of Boston, and Reuben Brackett, of Lynn, Massachusetts.*—This patent is obtained for "machinery for facilitating the evaporation of solvents, or fluids, and in various water-proof compositions or mixtures, from the cloth or other substance to which said mixtures or compositions may be applied, and also for condensing the same again, or converting them from an aeriform into a liquid state."

The cloth coated with a solution of India-rubber is to be wound upon a roll in such a manner, as to allow it to form a spiral with a space between each coil. The reel and the cloth so wound on it is then to be inclosed in a box or case of wood or of metal, fitting together so perfectly as to prevent the entrance or the escape of air. From the top of this case or box there is a tube leading to a condensing-apparatus of any convenient form. Heated air, or steam, is to be admitted into the case, either through the axis of the reel, if made hollow for that purpose, or through any other convenient opening, the effect of which will be to evaporate the volatile solvent. The claim is to the accomplishing this object, and to the collecting of the solvents by the means described.

APPLICATION OF WATER LIME CEMENT TO THE CONSTRUCTION OF ROADS, *Joseph Roby, New York.*—The whole system contained in this specification is that so well known of forming roads by the employment of hydraulic lime with beds of gravel, or broken stones of a suitable quality; the directions given do not contain any thing with which engineers are not familiar, and the patentee tells us, in conclusion, that "he would add to his specification and claim, the right to construct roads, streets, &c, by the use of water-lime or cement, in any other manner than above described:" a right which will be very readily conceded to him, provided it be not an exclusive one—to this both the ancients and the moderns may well demur. Our shelves would furnish a volume of evidence of the antiquity of such roads; we have opened the *Dictionnaire Technologique* only at the article "Cement," and give the following note:—"I have very recently had occasion to examine a piece of natural hydraulic lime, from which a hydraulic mortar of great excellence is prepared, and which is principally employed in the construction of cement pavements of very great solidity."

POCKET PISTOL, *Victor M. Wallace, Virginia.*—The object of this invention is "to give the greatest length possible to the barrel of the pistol, for the purpose of discharging the ball with increased velocity and greater precision in its direction, as well as to a greater distance." To effect this object the back end of the barrel is cylindrical, and is passed into the stock, reaching to its end, the part grasped by the hand descending nearly at right angles from the upper portion. The percussion cap passes on to a nipple at the centre behind the barrel, the trigger operating upon it through the intermedium of a main spring and other appendages, contained within the handle of the stock.

The claim "is not to the discharge from the centre of the breech-pin, but simply to the manner of construction described, namely, the rounded back part of the barrel, with the manner in which I insert the breech-pin, for the purpose of drawing the shoulders of both towards each other; also the disposition of the lock, as contained in the lower part of the grasp of the stock, also the interior of the trigger, and its adjustment as described."

There is some sacrifice made by rounding the back part of the barrel, as the breech is thereby rendered smaller than the outer, or muzzle, end; perhaps, however, means may be found to remedy this defect.

APPLICATION OF THE RISING AND FALLING OF THE TIDE TO THE PROPELLING

OF MACHINERY, *Henry B. Fernald, Portsmouth, Maine.*—" A buoy of sufficient strength and dimensions, connected by a rope or chain passing from the buoy under a pulley at the bottom of the water, with a wheel which moves the machinery. In the falling of the tide, or water, the weight of the buoy, filled with water by means of a stop-cock, or otherwise, operates as a propelling power, being so connected by another rope or chain to another wheel, as to operate alternately with the wheel above-mentioned.

" What I specifically claim as my invention or discovery, is the principle of applying the rising and falling of the tide, and other water, to the propelling machinery."

A patent was granted on the 23rd of December, 1829, to Henry M. Webster for a " tide power," in which it is said that " the object which the subscriber proposes to effect is to bring into value and use the rise and fall of the tide on the seaboard, and particularly in the principal cities of the Union, to be employed in manufacturing and other purposes."

The two plans, it will be seen, are identical; in the first patent it is proposed to use " vessels or floats of great weight and buoyancy," " a condemned or other hulk of a ship of required size," being mentioned as suitable for the purpose.*

IMPROVEMENT IN THE SAW MILL SAW, *Levi Fisk, New York.*—Every third tooth of a saw mill saw is to be sharpened to a cutting edge on its upper side, the teeth so sharpened being alternately on reverse sides of the saw; these teeth are then to be so set as to cause them to take a thin shaving off in their ascent, and thus to plane the sawed stuff, or to render it much smoother than is done by the common saw. It is said that experience has shown that the best effect is produced by so sharpening every third tooth, although an adherence to this number is not absolutely necessary. The claim is, to " the *upper oblique* edge of saw teeth being cut to the right and left alternately, and set together, or betwixt any number of common teeth, for the *upward* motion of the saw, for the purpose of sawing wood in a smooth manner, as above-described."

CONSTRUCTING GRANARIES, *John Harmony. Chambersburg, Pennsylvania.*—The thing here patented is very simple, and, if effectual, is of great value. The " improvement consists in introducing a hog or sheep pen, either under or very close to a suitable room, or apartment, into which the grain is to be put; having found, by repeated experiment, that the effluvia of the pen, or some such cause, operates as a complete preventative against the attacks of the weevil, and also that, should the grain be infected by them, they will speedily leave it." After this information, the patentee describes what he esteems a good plan for the erection of such an establishment; but the particular mode is not considered as important, the claim being simply to " the combination of a hog-pen, or sheep-pen, with a granary, as set forth."

IMPROVEMENT IN STEAM-BOILERS, AND THE METHOD OF FEEDING THEM, *Nathan Reed, Belfast, Maine.*—The construction of this boiler, with its appendages, is very clearly described, and well represented in a good outline drawing; the things claimed, also, are distinctly set forth, leaving nothing to desire on this point.

The boiler is to be cylindrical, and is to contain within it a furnace, and a flue passing through it, in the manner of many others. The boiler is not to be placed horizontally, but is to be elevated at its back end, as shown in the drawing; this elevation is equal to one-half of its diameter. From the back end of the boiler there rises a vertical cylinder, which is to be the reservoir for steam, it being intended to keep the boiler entirely full of water, and to allow it to rise to a certain height also in the reservoir. The reservoir contains a float, which is to be sustained by the water, and from this float rises a vertical rod, passing through a stuffing-box at the top of the reservoir. The apparatus by which the feeding of the boiler is to be regulated is governed by a lever, acted upon by the rising and falling of the float-rod. One peculiarity of this arrangement is, that the feeding of the boiler is to proceed when the motion of the engine is stopped; in this case, if the water is sufficiently low, a tube is opened, by the turning of a stop-cock, which admits a portion of steam from the reservoir into a case containing a small rotary-engine, or steam-wheel, constructed like an ordinary water-wheel, which is blown round, and works the supply-pump of the engine; when requisite, a portion of the steam blows off through another tube, opened at the same time with the former, as, otherwise, the velocity of the feeding-engine might be too great.

The claims made are to the construction of the boiler, so that every part exposed to

* The application of the tides as a motive power was suggested and discussed in the *Mechanics' Magazine*, vol. xvi. pp. 375 and 436, and vol. xix. p. 167. The first mode proposed by our then correspondent differed altogether from either of the e which have been patented in America. Dr. Gregory, too, in his " Mathematics for Practical Men," mentions that tidal power has been applied to pulling out old piles from rivers.—ED M. M.

the action of the fire shall be kept constantly full of water, whilst the steam generated shall ascend freely into the reservoir, where it is isolated from the direct influence of the fire by a stratum of water. The manner of fixing and connecting the float, so as to ensure a more frequent action of the feeding-apparatus. The method of giving vent to the accumulated steam, by the same operation which shuts off that from the engine; and the method of diminishing the velocity of the feeding-engine, by the additional waste-pipe.

Were it not the case that floats, rods sliding in stuffing-boxes, supply-pumps, and other apparatus usually combined and connected in self-regulating and self-feeding contrivances, added to steam-engines and their boilers, are each liable to derangement from causes which cannot be rendered self-regulating, we should expect much from the apparatus described, which is ingeniously imagined, and looks well upon paper; but we are admonished, by some knowledge of practical results, not to trust implicitly to fair promises, and specious appearances, especially where complicated machinery, and powers of difficult management and control, are concerned.

FIRE-ENGINE, *Thomas Odiorn, Portsmouth, New Hampshire.*—In this fire-engine the box that is to contain the water is covered with a circular platform upon which the persons who work it are to walk; the engine being worked exactly in the manner of a ship's capstan. The head into which the levers are inserted revolves upon a hollow shaft through which the tube ascends that leads to the crane neck. There are teeth on the lower edge of this head, forming it into a crown-wheel, and these take into four pinions, having cranks on them, which work the pistons of four pumps, forcing the water into a central air-vessel. The claims made embrace the particular mode of constructing and working fire-engines, as above described.

MORDAN AND CO.'S PATENT TRIPLE-POINTED PENS.

3 2 1

"'Tis senseless arrogance t'accuse
Another of sinister views,
Our own as much distorted."

Sir,—It is a great pity that some indivuals are unfortunately endowed with such peculiar powers of perception, as to believe—or rather to suppose the world will believe, that that while indulging private animosity, and endeavouring to inflict personal injury, unprovoked and wholly undeserved, they are promoting the public good!

Doubtless this "*pro bono publico*" principle of action had its due influence in originating a well-known Portuguese proverb respecting "*good intentions*," adverted to by Lord Byron in his Don Juan.*

These remarks have been elicited by the tenor of a communication in your last number, page 111, the writer of which has concealed his name, and thereby his motives, from the majority of your readers, under the shelter of an anonymous signature.

"Scrutator (*pro bono publico*)," save the mark! has endeavoured to cast a slur upon the highly respectable firm of Messrs. Mordan and Co., by insinuating that they have surreptitiously appropriated, and even patented, an invention belonging of right to another individual. Having myself acted the part

* Canto VIII. Stanza 25.

of *midwife*, as it were, to this invention, I feel myself called upon to offer a short explanation of the matter, which I am quite sure will place Messrs. Mordan and Co., as well as the author of this ungracious attack, in a proper point of view before your readers.

Mr. Gowland is the undoubted inventor of three-nibbed metallic pens, as stated in "Scrutator's" extract from Mr. Carstairs' pamphlet. Mr. Gowland having shown his invention to many other persons, at length submitted some of the pens, to which he had affixed a third nib, to my inspection, requesting my opinion of their merits. I was immediately struck with the great importance and value of Mr. Gowland's contrivance, and I forthwith waited upon Messrs. Mordan and Co. for the purpose of calling their attention to the subject; these gentlemen, with their usual acumen, at once saw and duly appreciated this novel improvement.

Upon inquiry being made, it was found that Mr. Gowland had published his invention to such an extent, as to render its being made the subject of a patent altogether out of the question.

Messrs. Mordan and Co. perceiving, however, that this was, in fact, *the only true principle* for making *good* metal pens, determined on taking up the invention, open as it was, on terms highly creditable to themselves, and advantageous to the ingenious inventor.

Many practical difficulties, however, arose in attempting to manufacture this pen; the original plan of Mr. Gowland, as well as an improvement of my own, which I submitted, being found incompatible with due economy of manufacture. But Mr. Mordan was not to be foiled and his ingenuity soon surmounted other difficulty; and by a happy experiment, he struck out a mode of manufacture which rendered the construction of three-nibbed pens, in a perfect form, very easy of accomplishment; which method, the firm deemed it advisable to secure to themselves by patent.

If "Scrutator" will take so much trouble as to refer to the correct list of patents which you have given at page 64 of your present volume, among others, he will find one reported to have been granted "To Sampson Mordan, of Castle-street, Finsbury-square, mechanist, *for an improvement in making or manufacturing* triple-pointed pens."

Observe, not for a three-nibbed pen, that is Mr. Gowland's invention—but for Mr. Mordan's original and ingenious mode of *making that article.*

That the peculiar process of manufacture is a legitimate subject for a patent, nobody having an ordinary share of common sense would attemp to deny; every body in any way conversant with these matters, knows that numberless cases might be quoted to prove that such is an every day practice.

Thus, for instance, on reference to the list of patents given in your last volume, it will be seen that bobbin-net, brandy, chloride of lime, cotton, gas, iron, oxalic-acid, paper, pens, soap, screws, silk, and vinegar, as well as distilling, diving, dyeing, embossing, evaporating printing, weaving, and many other things, milking of cows, even included—none having the slightest claim to the title of *new inventions*, have yet, in their respective processes and *modes of manufacture*, been recently made the subject of good and lawful patents.

It is, therefore, *not* any matter of surprise, "that gentlemen so long in the field of invention and *bona fide* manufactures, as Messrs. Mordan and Co., should, like other people, take care to secure to themselves, by legal means, the fruits of their own inventions.

Without condescending any farther to notice the ignorantly mistaken and paltry attack of "Scrutator," let me proceed to the more agreeable task of pointing out to your numerous readers, some of the peculiar advantages of this novel form of pen, and in so doing, I shall, for reasons which "Scrutator" will readily understand, quote largely from the pamphlet he has introduced to the notice of your readers.

In the accompanying drawing, fig. 1, is a back and side view of Mordan and Co.'s triple-pointed slip pen, by which it will at once be seen, that the third nib is cut out of the stem or shank of the pen, where there is alway, a superfluity of metal; this being turned back affords what really does appear to be the *ne plus ultra* of metallic pens—*the third nib.* Figs. 2, are back and side views of the flat spade; or as some, of the Birmingham makers style it, the Lunar pen, the third nib of which is obtained in pre-

cisely the same manner, as in the pen, fig. 1. With respect to this novel and important addition, Mr. Carstairs, at page 31, observes, "A very curious and useful improvement, and, as I conceive, a very necessary appendage to steel pens, has recently attracted my attention, and I consider it highly worthy of the notice of manufacture, as well as others. It is invented by Mr. James Gowland, chronometer-maker, No. 11, Leathersellers-buildings, London-wall. It is very ingeniously appropriated, and can be readily adapted, to almost all steel pens, with very evident advantage, more especially for the purpose of making the pen to hold an extra quantity of ink, as well as of supplying it, in uniform and never-failing succession, while the least ink remains in it. Every time the pen (to which it is attached) is pressed on the down strokes of the writing, the ink flows in a body towards the point, by the power of capillary attraction, the moment it is most wanted, and this effect is produced by the angle which is formed with the point of the appendage (*which is a curved piece of watch spring*), and the nib of the pen forming a kind of conical tube, with its smallest end placed downwards, tapering and increasing gradually in width upwards to its widest part, about three-eighths of an inch from the point or nib of the pen, with the point of the spring resting lightly at the back of the nib, thereby forming, when the pen is pressed on the paper, a *third point*, which also comes in contact with the paper, and always tends to make the ink flow equally as much on the centre of the down strokes, as the two points of the levers or prongs of the pen itself. Capillary attraction, which this ingenious contrivance possesses in a very high degree, counteracts completely the defect existing in all pens, and which arises from the opening in the slit tapering to an angle in the opposite direction to that which is requisite for the purpose of fairly conveying the ink to the paper, as any one may soon be convinced by pressing the points of any pen on the thumb-nail, or on any other hard surface, until the slit opens wide enough for large hand-writing, the ink will then instantly recede from the points towards the upper extremity or angle of the slit. Capillary attraction always causes fluids to flow towards the narrowest part or opening of every conical tube."

Figs. 3, are similar views of Mordan and Co.'s patent three-nibbed counter oblique pen. Speaking of this particular form of pen, at page 16, Mr. Carstairs observes, "A new steel pen has just been produced by Messrs. Mordan and Co., distinguished by the name of '*the counter oblique pen*.' The utility of their original oblique pen has been very generally acknowledged, as the great and extensive sale of them for the last three or four years will sufficiently evince. If the former was highly approved of, the great facilities and evident improvements produced in the counter oblique pen, must tend much to make it a favourite with the public. This novel and curious introduction will, no doubt, be hailed with delight by the admirers of steel pens, not from the peculiarity of its form, but for the advantages of its holding more ink, and retaining, from its obliquity, a direct position to the writing, while it balances itself; keeping always an unchangeable equilibrium! Many persons having been prejudiced against the form of the original oblique pen, has induced Messrs. Mordan and Co. to meet the wishes of every one; and in this praiseworthy attempt, they have succeeded in adding some essential and useful improvements in their new pen, which will no doubt be acceptable even to those who were the most opposed to their former pen, merely on account of its remarkable appearance! This new pen requires not only great care and nicety in the manufacture of it, but also very complex and finely adjusted machinery; and not one is permitted to be issued from the manufactory, until it has been minutely and critically examined, tried, and proved by a competent and able examiner!

"Messrs. Mordan and Co.'s counter oblique pen possesses in a high degree a free lateral opening, which is the action more or less of all steel pens, with no grooves or indentations crossing in the vicinity of the central slit; and therefore pens made without ribs or grooves, can never have the curvelinear spring which is natural to the quill pen; nevertheless, some individuals prefer pens which have a lateral expansion. That it may be explicitly understood what is

meant by a lateral opening, the impetus required to expand the slit, merely causes the slit to open in the same manner as two fingers may be opened, or separated from each other, without an uprising action; or, in other words, if we were to open a pair of compasses, though the legs appear in the position of expansion, yet it will be evident that the very action of their separation must be a linear, or lateral one, both right and left, without the least bending of the legs upwards, or downwards, which is precisely the same with pens without ribs, or channels, and that is the cause why the previously manufactured steel pens, in general, have not the easy flexibility of the quill pen. Now if the action and the expansion be not easy and free, the steel pens will write very harshly and stiff; but this is not the case with Mordan and Co's counter oblique pens, for they possess a very free and easy opening, and glide extremely smooth over the paper owing to the fine temper of their steel, and the perfection of the manufacture of their pens, by very superior machinery, &c.

"Upon the whole, I consider this oblique pen superior to many of its predecessors, and Messrs. Mordan and Co. are worthy of high commendation, on account of the great expense they have been at for tools and machinery, and in employing able mechanics to accomplish the end they had in view, namely, to produce a pen worthy of the public attention.

"As good steel pens cannot be produced from bad steel, and as steel varies extremely in its properties and qualities, it is therefore of the utmost importance to be very cautious in the choice of steel, and more particularly so as it respects its temper and quality. I believe I have at present in my possession one of the finest and most perfect specimens of steel ever produced in England, or any where else. With regard to its pliancy, it may be compared to the thinnest and finest whalebone, and it will re-vibrate to its former position after it has been bent double, end to end. Being highly carbonated, it is the only proper steel, and the most suitable for the manufacture of the best steel pens. Now this kind of steel may be more expensive, yet good steel pens from such a superior article would more than compensate for any extra charge on the pen; and it si greatly to the credit of Messrs. Mordan and Co. that this is the kind of steel they generally use in their pens."—"I cannot pass over unnoticed the personal exertions and perseverance which Mr. Mordan himself has, with never-ceasing and undiminished ardour, for many years, endeavoured to overcome every obstacle, in the hopes of obtaining ultimately a successful result. Messrs. Mordan and Co, have succeeded in producing a more excellent and natural pen, than all those who have tried every kind of metal, both mixed and unmixed, that the mind of man could possibly conceive or invent!"

Thus far, Mr. Carstairs, in addition to which it is only necessary to state that with three-nibbed pens the following important advantages are secured; viz. 1. A certain supply of ink, uniform with the most rapid writing. 2. The two nibs of an ordinary pen act only as dividers or tracers, while *the third nib* in the new pen, pressing upon the paper, conducts and distributes the ink. 3. The additional nib renders the same pen capable of writing the boldest text, or finest running-hand. 4. The third nib becomes a species of reservoir, holding a large quantity of ink without any risk of blotting. 5. The third nib acting in the slit of the pen, effectually removes the fibres as they are gathered from the paper, thereby removing the greatest impediment to the use of metallic pens. Finally Firmness in use is obtained by the third nib, and, at the same time, the flexibility is increased, and durability necessarily follows

One important fact is deserving of particular notice; viz. that persons who had been accustomed to sign their names to checks, &c. &c., in a peculiar manner with quill pens, have hitherto been compelled to accommodate themselves to the capabilities of steel pens when using them for that particular purpose; whereas, with the *triple-pointed pen*, the same freedom exists as in the quill, and it accommodates itself to the writer; instead, like all its predecessors, of compelling the writer to submit to the limited range of its capacity.

A jointed holder should always be used with these pens, to enable them

to be inserted or withdrawn, without injuring the third nib.

I remain, Sir,
Yours respectfully,
W. BADDELEY.

London, May 26, 1836.

LITERAL SPELLING.

Sir,—It is an old maxim, to begin when you can with the egg; and in this age of many beneficial and some Utopian reformations, I am of opinion it would be beneficial to reform the mode by which our infants are first taught to read, and that would be effected by the abolition of absurd *literal* spelling. *The words of our language are made up of the sounds of its syllables, and not of the sounds of its letters;* and if so, why are the sounds of those letters taught? Several attempts have been made by Berthaud, Mrs. Williams, and Anti-spelling, to accommodate the sounds of the letters to their sounds in words; but I would reform it altogether, and abolish them. This may be thought too sweeping a measure, but if your readers will take the trouble of examining, they will find that *literal* spelling is altogether time lost and worse. Let them try the word leg—*l, e, g*. What are these sounds, *leg* or *elegy?*

This foolish system is not followed in teaching music or French. A French master teaches his pupils the sounds of the French letters separately, as *aw, bay, say, &c.;* but he does not go on with this system, and say, "Now, my pupil, *vay-o-oo-ace—voo* (vous): *tay-o-oo-tay—too* (tout)." It is too absurd and roundabout. He says at once, "Look at that *vous*, it is *voo;* at that *tout*, it is *too;* don't forget, they are *voo* and *too* in sound, and *vous* and *tout* in sight;" and he remembers accordingly.

There is a strong and prominent feature in most (perhaps all) languages, and that is, the abundance of *short vowels;* they suit the early state of speech, whether in infants, as *ba, ma, pa, mam, pap, dad*—or in low-cultivated nations, as the Eskimaux, in *Ikmal-lik, Tussarkit, Tennitarpin*, &c. These short sounds far outnumber all the other vowel sounds put together; and if all others were expunged from our tongue, they would still form a language capable of conveying an extensive range of ideas. I would only have to do with *syllables*, as distinct sounds, at first. A child can tell this:—"*&* is and, and why not this, *and?* this is *y*, and why not this, *jee?* this *z*, why not this, *zed?*" Let any one dissect an English word as it is now first taught, and divide it into the *simple sounds* of which it is composed, and he will immediately find out that a child (poor thing) is instructed first to utter a number of simple sounds, and then expected to combine them into a compound sound, of which they do not form the elements or component parts. The child is first taught that this letter *a* sounds like *hay;* but perhaps the first syllable which it sees the letter in (*ab*) falsifies its previous instructions, for the letter *a* does not sound like *hay*, but somewhat like *hah*—and if it meet with the letter in the word *all*, it sounds neither like *hay* nor *hah*, but like *haw*.

I think the most judicious beginning would be to teach these first short vowel sounds unmixed. I intended publishing a first book on this plan, and had two sheets of it printed, but as I may not do so, I beg room for these remarks in your very useful work, and shall be glad of any comments upon them. My lessons are all of the following kind, reserving other vowel sounds for a higher grade or second book:—

ab, ad, ak, al, pa, ra, sa, ta, dad, dan, fan.
ed, ef, ek, en, beg, bed, bet, peg, pen, jet.
ib, id, ik, in, it, ix, fit, pil, din, nit.
ob, od, of, on, op, ox, bob, rob, pon, top.
ub, uf, us, ut, um, up, nup, rub, sud, sun.
on it, an ox, it is, if it is, is it up, or at it.
in a cap, is it a bat, mix it up, dad or mam.
run not in mud, pin her cap on, Tom cut his pen.
It cannot fit him, it is a bad job, it is as big as an ox.
It is a bad peg for his job, but Bob can lop it a bit for him.
Put it in a jar, or a cup, in his gig, but let him not sit on it.
Her bonnet is formal, but it is velvet.
Benjamin cannot get it into his cabinet, &c.

In these first lessons, all long, or other than short, vowels are excluded, so that when a child has once learned the sound of a vowel or letter, it continues the same (a very few anomalies excepted) through the book.

I remain, Sir,

Your most obedient servant,

SAXULA.

Jan. 8, 1836.

AERIAL LOCOMOTION.

Sir,—I was amused with an idea of one of your correspondents, that birds might be trained for aerostation; and as I have since 1826 had various thoughts on locomotion by mechanical means, I beg leave to lay before your readers my ideas on locomotive-balloons. In the first place, the form of body should resemble that of a fish of great velocity—salmon or bonetta. Next, I would have in the centre of the body a fan-blast, or bellows, the vent being at the tail; and beneath the belly a stage should be hung by copper rods, on which the winch to act on the fan-blast should be fixed. At the tail end I would have a large fan, to act as a rudder; and on each side of the body a sort of fin, to regulate the rising and falling, acted on by strings or cords held by the person at the tail-fan. It is not necessary to go to great altitudes; therefore, I propose that the gas to fill the body should be only in sufficient quantity to render the whole mass of the same specific weight as the atmosphere, or a trifle less—then by working the fan, motion would result. To progress, a nearly fair wind should be blowing, as this mode of transit can only resemble the compound forces of a river and a boat crossing, which produce diagonal motion; hence I consider the solution of the problem more curious than useful.

I had an idea of propelling vessels in a nearly similar manner, but have given it up for one more original, and perhaps better, as it will not require any sort of direct action of machinery on the water. The result will have all the appearance of a common sailer; and for a vessel of war, all will be entirely out of the reach of shot; steam or other power will, of course, be required as usual.

I am, &c.

KENANS.

April 30, 1836.

BRITISH IRON TRADE.

(Extract of a letter from Mr. Gerard Ralston to the Editor of the *American Railroad Journal.*)

In my last letter you will recollect I mentioned that the following advances in price had taken place in common (Welch) bars, viz.:

On 25th August the price at Newport and Cardiff was per ton		5*l.* 10s.
On that day the manufacturers advanced the price .	10s.	
September 12th they advanced it again	10s.	
October 2d	10s.	
December 1st . . .	12s. 6d.	
		2*l.* 2s. 6d.
		7*l.* 12s. 6d.

Thus you see there has been a further advance of 12s. 6d. per ton since my letter to you. But the price of 7*l.* 12s. 6d., as fixed by the meeting of Welch iron-masters at Romney, on the 1st inst., is not observed by some of the leading houses, who refuse to sell under 8*l.* per ton, and others decline orders at all, for the present, alleging that their engagements are already so heavy, and the prospects of the trade are such, that they prefer to confine themselves to the execution of orders on hand, and thus enable them to take advantage of increased prices in the spring. The meeting at Romney adjourned to assemble again on the 12th January next, when it is confidently expected the price of 8*l.* will not only be generally confirmed, but that a further advance of 10s.* The iron market is in a most extraordinary state; the demand is far greater than the supply, which it is impossible to increase immediately, owing to the inability to obtain competent workmen to mine the coal, ironstone, and limestone, and to manufacture them into iron when procured. Aid cannot be expected from the lead, copper, tin, and other manufacturers of metals, which would be practicable if these branches were in a depressed state; but so far from this being the case, these trades are in nearly as flourishing a condition as the iron trade. Hitherto

* The present price (June 6th) of British bar-iron is 12*l.* per ton.—ED. M. M.

the iron-masters always considered themselves fortunate, if they could get through the winter without a decline in prices. *Now, in the month of December*, the effort of the most judicious among them is to prevent too frequent and too great advances of price, which they deprecate, lest consumption should be checked; and also, what they fear more than any thing else, the workmen should combine, and 'strike' for higher wages.

You may inquire what effect has been produced on railway iron. I can answer, by quoting my own experience. I have within a week received an order for a very large quantity (so large that I have not revealed it to any one lest it should affect the market,) of railway iron from America. I have issued my circulars to all the houses in this line, and I find a most wonderful alteration in the tone of their communications; formerly they were all eagerness to give an answer by return of mail, and they manifested the greatest anxiety to secure the whole order, or as much of it as possible. Now, some of them decline making tenders altogether, owing to the magnitude of engagements on hand; others, rather than break off connexions, mention such high prices for very small parts of the total quantity wanted, that they think they will not be accepted. A decided indisposition is manifested to come under any further engagements, unless at exorbitant prices, until it is ascertained what will be the result of the adjourned meeting at Romney on the 12th January. I very much fear that the same pattern of rail, which I put out in the middle of September last at 8*l.* per ton, will not now be contracted for under 10*l.* per ton, but I will do my best to screw them down to the lowest price. Notwithstanding the present high price, I have every reason to believe that prices will be still higher in the spring; for since I wrote to you, I have traversed the whole iron region, visiting every establishment of any importance, and every where I found an activity and bustle which I never before witnessed during my long experience in this business. Every establishment is full, to excess, of orders, and the greatest exertions are making, day and night, to execute them. The Pacha of Egypt's order for about 5,000 tons for the railway across the Isthmus of Suez, is about one-half completed; but others pour in from France, (there are two recently from that country for about 6,000 tons,) from Germany, Belgium, America, and every part of this country, in a way to astonish even the most enthusiastic friends of the railway system. Besides this demand for railway iron, the consuption of other kinds of iron fully keeps pace with it. This country being in a more prosperous condition, and every branch of trade, cotton, silk, wool, flax, hemp, tin, lead, copper, &c., being more flourishing, than at any period since the termination of the Napoleon wars; it is reasonable to suppose, and such is the fact, that iron, which is the foundation upon which the arts of civilized life rests, should be in great demand, when all other branches of industry flourish. Hence the demand for domestic consumption for ordinary purposes is very great, which, when added to the demand for foreign countries, and railway purposes, you may easily imagine will readily account for the present prices, and the prospect of still higher in the spring, unless war or some other calamity should ensue to check the brilliant progress of civilization arising from the long continuance of peace.

PRESERVATION OF ANIMAL SUBSTANCES BY CARBONIZATION.

[A short notice of this new discovery appeared in our 667th Number. The following additional particulars are from the *American Journal of Science and Arts*.—Ed. M.M.]

The following are some of the objects that have been subjected to the petrifying process. One of Sig. Segato's first experiments was performed upon a Canary bird. It is still preserved unaltered, although it is now ten years since the experiment was performed; and it has been submitted to the action of water and of insects. A parrot retains its original brilliancy of plumage, unimpaired. Eggs of the land turtle, turtles, various tarantulæ, a water-snake, a toad, various kinds of fish, snails and insects, are in a perfect state of preservation. To these, are

The point of maximum vaporisation which, with the clean surface, was between 294° and 299°, was raised by oxidation to 317½°, and by an increase in the roughness of the surface to about 348°.

Comparison of Results for Copper.

4. A comparison of the results thus obtained for the vaporisation from the surface of copper ·07 inch thick, under different circumstances, are contained in the following table; which indicates also, pretty nearly, the relative times of vaporisation of the same very small quantity of water under these circumstances.

The temperature of the liquid drops, and the pressure under which they were vaporised are elements which, of course, it is unnecessary to consider, although it was deemed safer to enter them upon the original notes than to omit to notice them.

Nature of Surface.	Temperature of maximum Vaporisation.	Time of Vaporisation.	Temperature of Repulsion.
	Fah.°	Seconds.	Fah.°
Surface highly polished,	292	3	315
„ tarnished,	325½	<1	
„ polished,	328½	2 & 1½	350
„ rough but clean,	296½	¾	
„ oxidized,	317½	¼	338
„ very much oxidized and not clean,	348	¼	

The results thus compared are probably as accordant as ought to be expected, and indicate the effect of smoothness of surface to be to lower the temperature of maximum vaporisation, but to increase the time required to vaporise at that temperature. Thus in the two extremes of high polish and considerable oxidation, the temperatures of maximum vaporisation are 292° and 348°; and the times of vaporisation, 3 seconds and ¼ of a second. The nearness of the point of repulsion to the temperature of maximum vaporisation is shown in those cases where the point at which perfect repulsion took place, was noted, nearly; the temperature exceeds that of maximum vaporisation by about 21°.

Vaporisation of Drops of Water by Iron.

5. Experiments were also made to determine the temperature of maximum vaporisation of water by iron with different states of surface, and as they preceded those made with the copper, the number of series was more considerable, that care might in a measure supply the place of experience. It will be wholly unnecessary to give the details of each series, since the mode of experimenting has already been stated, and the results can alone be of interest. At the same time, the temperature at which perfect repulsion of the drops took place was observed. A portion of the experiments were made in an oil bath, others by communicating the heat through tin.

In the following table are the results for a bowl of wrought-iron (No. III.), three-sixteenths of an inch thick; the surface was cleaned with acid and alkali after each series: it was not very different in smoothness in the different series, until the closing one, which is marked in the table. The oil bath was used in these experiments. The drops of water were let fall from a dropping-tube, and 128 were required to make one-eighth of a fluid ounce; each drop, therefore, weighed about ·45 of a grain.

The column of remarks in the following table, is intended to contain principally the temperatures at which the repulsion was observed not to be perfect, and gives an idea of the approximation to the true point of repulsion which each individual observation affords. These numbers obviously differ from those for the temperatures of perfect repulsion less than these latter among themselves, and much less than might have been expected, from the uncertain nature of the effect of slight inequalities of surface.

Temperature of Maximum Vaporisation, and of perfect Repulsion, of drops of Water let fall upon the sides of an Iron Bowl, three-sixteenths of an inch thick.

No. of Series.	Surface clean. Temperature of maximum vaporisation. Extremes.	Mean.	Repulsion.	Remarks.
First series, ascending			382½	Maximum vaporisation passed, at 336½°. Repulsion not perfect at 378½°.
Second series, descending	331½ a 334½	333	373½	Repulsion not perfect at 370½°.
Third series, ascending			386½	" " at 385°.
Fourth series, descending	337½ a 341	339	382	" " at 378½°.
Fifth series, ascending	327½ a 331½	329½	390	" " at 389°.
Mean		333·8	382·9	
	Surface oxidated from use in the foregoing.			
Sixth series, ascending	343 a 350	346½	385	Drop breaks on irregular parts of bowl even at this point, i. e. repulsion not perfect.

6. The following table contains another series of results with a thicker iron; they show that the cooling effect in the series just given was imperceptible, no change in the position of the point of maximum vaporisation having been produced by the increase of thickness, that is, by substituting a metal as the source of the communicated heat for an equal thickness of oil. This bowl was very highly heated after the first experiment, so as to cover its surface with a scale of oxide, and the results accord entirely with the similar ones already given, the temperature of maximum vaporisation being raised.

Vaporisation of water by an Iron bowl one-fourth of an inch thick.
Surface cleaned with acid and with alkali.

Temperature of Maximum Vaporisation. Side drops.	Centre.	Temperature of Repulsion. Side.	Centre.
337½	358	405	
Scale of oxide by high heat.			
381½		433	456¼

In the only other series of experiments with which the Committee are acquainted, and which have been directed to the same point, those of Professor Johnson, the point of maximum vaporisation is placed at between 304° and 320° Fah. The different nature of the surfaces employed may perhaps account for the difference of this result from that of the Committee.

7. The repulsion as developed in solid tin, when heated, was made out from the experiments given below. The figure of the surface of tin was that of the under side of bowl No. VIII. viz. a portion of a spheroid nearly coinciding with a sphere of 3·35 inches radius; the surface itself was tolerably smooth, conforming to the exterior of the iron bowl; there were, however, small irregularities in it.

Table showing the Temperature of Maximum Vaporisation for Tin. Surface slightly corrugated.

Centre drops. Temperature.	Time in Seconds.	Remarks.
276½	1½	Side drops not repelled.
302 a 321½	¾	
338 a 364½	½	
379	<½	
393	·6	Ten drops in six seconds.
409½	·5	Side drops repelled.
419½	·45	Maximum vaporisation.
426	·5	
430	·56	
444	·6	
454	1·5	Tin not melted at surface, though the thermometer is 14° above its melting point below. Thermometer has been compared by the test of melting tin.

The experiments which follow the remark, "ten drops in six seconds," were all made by dropping several drops, not enough, however, to cool the surface down; measuring the time for the whole number, and dividing by that number. The point of maximum vaporisation is placed, with probability, at 419°, the times had certainly increased in rising to 444°; but in descending, the same certainty is to be found only on reaching 321½°. This slightly rough but polished surface, as it may be considered, had its temperature of maximum vaporisation very certainly above that of the polished copper and of the smooth iron. The time of vaporisation of a drop at this temperature was less than one-sixth of the corresponding time for the polished copper, and less than that for the clean copper surface; agreeing more nearly with that for the smooth iron, which was much its inferior in lustre. A correct induction could only be had by varying the number of metals, and by frequent repetition of the results; but so far as these experiments go, they indicate that this repulsion does not depend alone upon the relative polish of the different metallic surfaces.

8. The conclusions which they fairly warrant are as follows:—

1st. With the same metal, the temperature of maximum vaporisation of water is lower, as the smoothness of the surface is greater, and the amount of vaporisation in a given time at this temperature is much diminished. In copper, the effect of polish and of oxidation, the two extremes, is shown by a difference in the temperature of maximum vaporisation of 56°, that point being in the two cases, 292° and 348°. Further, the ratio in the times of vaporisation at these two points is as 12 to 1, or for the same drop of water, 3 seconds and ¼ of a second. In iron, the smooth surface gave, for the temperature of maximum vaporisation, 334, or 337½°, the oxidated 346½°, differing but little from the former; but when highly oxidated, gave 381°, or a difference of about 45°, the time of vaporisation not differing greatly in the two cases.

2d. The temperatures of maximum vaporisation for copper and iron, in similar states of surface, differ between 30 and 40°, the iron having the higher point. The time of vaporisation at the maximum is less in the copper than in the iron, in the ratio, probably, of 2 to 1, or nearly in the ratio of their conducting powers for heat, which are as 2½ to 1.

3d. The temperature of maximum vaporisation for oxidated iron, or for highly oxidated copper, corresponds nearly to that at which steam has an elastic force of nine atmospheres. But the vapour was formed under atmospheric pressure only.

4th. A repulsion between the metal and water is perfect at from 20 to 40° above the point of maximum vaporisation, following more closely upon the temperature of maximum vaporisation in copper than in iron. At these temperatures the water does not wet the metal. The drops of water are put in rotary motion in variable directions, and sometimes remain at rest, slowly vaporising. When very small, they sometimes leap vertically from the surface of the metal. They seem to vaporise from the side next to the metal.

A general view of the facts just deduced is given numerically in the following table:—

Table showing the Temperature of Maximum Vaporisation of Drops of Water in Copper and Iron Bowls.

Nature of the Surface.	COPPER ·07 inch in thickness.			IRON 3-16ths inch thick.		IRON ½ inch thick.	
	Temperature of maximum vaporisation.	Time in seconds.	Temperature of repulsion.	Temperature of maximum vaporisation.	Temperature of repulsion.	Temperature of maximum vaporisation.	Temperature of repulsion.
Highly polished	292°	3	315				
Clean, not polished	296½	¾		334*	383	337½	405
Oxidated	321	½		346½†	385		
Highly oxidated, and not clean	348	¼	338				
Ditto, but clean						381	433

There can be no doubt that, at the temperatures determined as those of maximum vaporisation, an effective force of repulsion between the heated metal and the water has

* Mean of three series. Time between 1 second and 1½ seconds.
† Time about 1 second for .45 gr. of water.

begun to be developed. For we may assume that heat will tend to pass from the metal to the water the more rapidly as the temperature of the former exceeds that of the latter, which would tend to increase the vaporisation after the repulsive action had commenced.

The temperatures of maximum vaporisation are reached in practice in the high-pressure steam-engines. The locomotives with flues of copper use steam of 60lbs. pressure upon the safety-valve, corresponding to nearly 306° Fah.; a temperature which is but 15° below that found for the maximum vaporisation by oxidated copper. The iron boilers of our high-pressure engines use steam of from ten to eleven atmospheres, or from 354° to 360° Fah., the higher temperature being about 20° below the temperature found for the maximum vaporisation of water by an oxidated surface of thick iron.

It is possible, and indeed probable, that pressure may modify these results, all of which were obtained under atmospheric pressure. Pressure, tending to counteract the effect of the repulsion between the heated metal and water, would probably raise the temperature of most rapid vaporisation.

Vaporisation of considerable Quantities of Water.

9. The results already presented, however interesting they may be in a practical or in a philosophical point of view, cannot be said to touch the question of the effect of the contact of water suddenly made with hot metal, in producing explosions. It is necessary to suppose so large a quantity of water, brought under the vaporising influence of the metal as, except where there is a violent repulsion by the heated metal, to reduce materially the temperature of the surface. To study the question in this point of view, we must ascertain, if possible, the law, according to which a variable quantity of water, thrown upon heated metal, is capable of reducing its temperature, so as to produce the maximum amount of vaporisation. That such a maximum may be found will be seen by considering the foregoing results. They show that an effective repulsion is developed between water and heated metal, increasing rapidly after a certain temperature, at which the vaporisation is a maximum. Now, water thrown upon a surface at its temperature of maximum vaporisation, would cool it down rapidly below this temperature. Again, if thrown upon it at a temperature when the repulsive effect was very strong, it would not be able to cool it down as low as the temperature of maximum vaporisation. Somewhere, then, between the points thus referred to, there will be an initial temperature, at which the vaporisation will be the greatest possible, or a given quantity of water will be vaporised in the least time. It is obviously not as easy to solve this problem as the preceding one, nor can so satisfactory results be expected, nor results so constantly reproducible; its practical importance required that its solution should be attempted; and the method adopted was as follows:—The same baths, viz. oil and tin, were used as in the foregoing series, to ascertain, generally, the effect of communicating heat through different media. Different metals, copper and iron, with different thicknesses of each, and different states of surface, were subjected to trial. The quantity of water was gradually increased, from small quantities, scarcely capable of reducing the temperature of the surface when the repulsive tendency was fully developed, to quantities as considerable as the bowls could contain. The study of each case was, of course, attended with much labour. In the greater quantities of water the temperature of the metal of the dishes was so much reduced as to affect that of the bath itself. Accordingly, a mean of the temperatures, observed at regular intervals, is taken as the temperature of the bath on which the water was thrown, and which, taking the entire mass into consideration, was supplying an amount of heat due to that temperature, to the parts adjacent to the bowls. The oil bath was stirred to produce, as nearly as practicable, a uniformity in temperature in the different parts.

Without knowing the temperature to which the parts of the heated metal, or of its bath, are reduced by the affusion of water, this kind of experiment supplies precisely the answer to the question in practice; *at what temperature of a metal will water, thrown upon it in a limited quantity, be most rapidly turned into steam?* Making due allowance for the different modes of communicating heat in the experiments and in practice.

Copper Bowl, No. VII.

10. The same bowl used in a former series of experiments was again applied, the surface being smooth. This bowl was a portion of a spheroid, approaching nearly, in its inner surface, to a spherical surface of 3·09 inches radius: the versed sine of the segment, or depth of the bowl, was 1·6 inches; and its chord, or the breadth of the bowl, 5·39 inches. The thickness of the metal was ·07 of an inch.

The quantity of water first introduced was one-eighth of an ounce by weight (60 grains troy), the water being weighed in a small metallic dish, and thrown into the bowl placed in the bath. One experimenter observed the temperature of the bath, and gave notice to another of the instant of introducing the water; the other made a memorandum

of the temperature and time. The first observer gave notice of the instant at which the liquid began to boil, which was also entered upon the notes. The second then announced each minute, or half minute, as it passed, and the first gave the temperature of the bath at that time, stating also the circumstances taking place in the bowl when remarkable. The same observer also gave warning when the liquid was about to disappear, and a signal at the instant of its disappearance, which was marked by the second. The time between the introduction of the liquid into the bowl and its beginning to boil is deducted in each case in the following tables, so that they show the times necessary to vaporise the water, after it had been raised to the boiling point. At the high temperatures, the time required to raise the smaller quantities of water to ebullition, scarcely amounted to half a second. The times were noted, usually, by a pendulum beating seconds, sometimes by a quarter-second pendulum.

When a decided repulsion has commenced with these considerable quantities of water, the phenomena are of a very singular kind. The water assumes a rotary motion about an axis perpendicular, or nearly so, to the lowest point of the dish, and at the same time its figure changes, and, from being circular in its horizontal section, becomes of an irregular oval, which contracts and dilates alternately as the mass revolves; the transverse axis contracting until its place is occupied by the conjugate, and *vice versâ*. The direction of this rotation is not at all uniform, and the mass sometimes becomes quiescent, and then assumes motion in an opposite direction. When this state of things first begins, vapour sometimes bubbles or bursts up through the liquid; but when fully established, it is most copiously given off from below. In fact, the appearance is that of a stratum of vapour, between the water and the bowl, which becomes at times visible when condensed at the edges.

If the results of the vaporisation of one-eighth of an ounce of water in bowl No. VII. be taken, and a curve be traced from them, of which the ordinates represent the differences between the times of evaporation and a constant quantity, and the abscissæ the differences between the temperatures and a constant quantity, a remarkable regularity will be found in the results, and an approach to a minimum in the time of vaporisation. This affords good grounds for attempting to calculate the temperature at which the maximum vaporisation, with this quantity of water, would have taken place; or the temperature above which the water introduced would not be able to cool the bowl as low as the temperature of maximum vaporisation for drops of water. The obvious approximation of the curve just referred to, (see plate 5, fig. 1*), to the ellipse, induced the trial of the equation of that curve to represent the observations. The following table shows the results of the comparison of calculation and observation, the transverse of the ellipse being assumed equal to 262°, and the conjugate to 200 seconds, and the co-ordinates of the centre being 576° and 211·5 seconds.†

No. of Experiment.	Observed Temperature of Vaporisation.	Observed Time of Vaporisation.	Ordinates from Observation.	Calculated Ordinates.	Difference.
	Fah°.	Seconds.	Seconds.	Seconds.	Seconds.
1	349·5	116·5	95·	100·1	+5·1
2	384·	71·	140·5	135·4	—5·1
3	420·5	46·	165·5	160·3	+5·2
4	452·	32·5	179·	175·4	—3·6
5	486·	22·	189·5	187·	—2·5
6	508·	18·	193·5	192·3	—1·2
7	526·	15·5	196·	195·4	—0·6
8	537·5	15·3	196·2	196·8	+0·6
9	558·	14·7	196·8	198·6	+1·8
10	568·	13·	198·5	198·9	+0·4

A similar comparison which addresses itself, even more directly to the eye, is given in fig. 1, plate 5, in which the upper dotted line is that traced from the observations, and the full line is the ellipse which has been assumed.

The general coincidence of these lines, varying only when the observations are indi-

* We have not yet received from America the plates 5 and 6 referred to in the portion of the Report given this week.—Ed. M.M.

† That is, in the equation $A^2y^2 + B^2x^2 = A^2, B^2$; $A = 262°$ and $B = 200$ seconds. $X = 576°$, and $Y = 211·5$ seconds, are the co-ordinates of the centre. So that $x = 576°$—the observed temperature, and $y = 211·5$ seconds—the observed time of vaporisation.

cated, by the nature of the dotted line, to have been irregular, or the near coincidence of the calculated and observed numbers in the table, and the variable sign of the differences, justify us in assuming the true maximum of vaporisation at the temperature corresponding to the highest point of the ellipse, namely, to 576° Fah.

At about 576° Fah. then, a bowl of copper ·07 of an inch thick supplied with heat by a medium like oil, would be able so far to resist the cooling action of 60 grs. of water, as to produce the most rapid vaporisation; the quantity being sufficient to cover about one-tenth of the surface exposed to heat.

Copper Bowl, No. IV.

11. This bowl was thinner than the last, its thickness being ·05 of an inch. Its figure within approached nearly to a sphere of 3·1 inches radius, the chord of the segment being 5·25 inches, and the versed sine 1·45 inch; it deviated as little, therefore, from the figure of the last as could have been expected from the mode of forming it.

Nine observations were made of the vaporisation of one-eighth of an ounce of water in this bowl, placed in a bath of oil. Of these, seven are shown in the middle dotted line of fig. 1, plate 5, and agree very well with the ellipse traced in the full line; the two omitted were at temperatures lower than that of the lowest of the seven included in the figure. The following table shows the comparison of calculation and observation, assuming the major and minor axes of the ellipse to be respectively 251° and 214 seconds; and the co-ordinates of the centre 576° and 254 seconds. These values were not obtained rigidly, but they agreed better than numbers, greater and less, which were also tried.

No. of Observation.	Temperature of Vaporisation.	Time of Vaporisation.	Observed Ordinates.	Calculated Ordinates.	Difference.
	Fah°.	Seconds.	Seconds.	Seconds.	Seconds.
3	352	164	90	96·6	+6·6
4	382·5	118	136	136·3	+0·3
5	433	78	176	176·0	+0·0
6	464·5	62	192	191·8	—0·2
7	491	54	200	201·1	+1·1
8	511	48·5	205·5	206·7	+1·2
9	527	43	211	210	—1·0

The temperature producing the greatest vaporisation with 60 grs. of water in a copper bowl ·05 inch thick, would be nearly 576° Fah., or about the same temperature as with the greater thickness of ·07 inches. The surfaces were nearly alike in the two cases, and both were clean but not polished.

Bowl, No. I.

12. Was thinner than either of the foregoing; its thickness being only ·025 of an inch. The figure was nearly the same as the foregoing, and the quantity of water used and nature of the bath were the same.

Of eight observations made and recorded in the following table, five only appear to belong to the same curve; this is seen in the lowest curve, plate 5, fig. 1, in which the dotted line represents the curve of observation. These five may be represented by a circle determined from observations 3, 4, and 8, which give for the radius 262°. The co-ordinates of the centre are 604° and 309 seconds.

No. of Observation.	Temperature of Vaporisation.	Time of Vaporisation.	No. of Observation.	Temperature of Vaporisation.	Time of Vaporisation.
	Fah°.	Seconds.		Fah°.	Seconds.
1	306·5	397	5	422	118·5
2	319	369	6	452·5	101
3	354	237	7	483·5	76
4	387	163·5	8	505	67

The calculations place the maximum of vaporisation about 604° Fah., or 28° higher than the temperature shown by the other bowls, an effect due, of course, to the thinness of the metal of this bowl.

Vaporisation in Iron Bowls.

13. Similar experiments were made with iron bowls of different thicknesses; No. V. ·04 inch, No. II. ·08 inch, No. VI. ·18 inch, and No. III. of an intermediate thickness between Nos. II. and VI. The curvatures and general dimensions were intended to be those of the copper bowls, from which they in reality differed in no important particular. The radius of No. V. was 3·25 inches, of No. II. 3·1 inches, of No. VI. 2·9 inches; the chord of No. V. 5·2 inches, of No. II. 5·2 inches, of No. VI. 5·2 inches, the versed sine of No. V. 1·3 inches, of No. II. 1·45 inches, of No. VI. 1·6 inches. The difficulty of producing a uniform surface, and of retaining one of any smoothness, for a considerable time made these experiments much less satisfactory than those on the copper; in those with No. V. and No. II. oil obtained access to the cup and vitiated part of the results, and this was also the case at high temperatures with No. I. Small particles of water being thrown out of the dish, sunk below the oil without evaporating, and then in passing into vapour below the surface, threw up the oil with slight explosions. The surfaces were rough but clean, the quantity of water used $\frac{1}{8}$ oz. troy. The curves representing these observations are shown in plate 6; and through the striking irregularities in the three lower ones, we see the effect of thickness of metal in increasing the amount of vaporisation at a given temperature, the curve of No. III. being higher than that of No. II. and of No. II. higher than that of No. V.; and we also see a tendency towards a maximum lying above 540° Fah., though, from No. III. and No. V. obviously not far above it. The difficulty of passing the maximum with these thin bowls consisted chiefly in the acrid nature of the vapour given out by the oil, which acting powerfully on the eyes, rendered accuracy extremely difficult, and the effort sustained very painful.

With bowl No. VI. greater pains were taken to smooth the surface, and this was cleaned with alkali to free it from grease, and then with very dilute acid, which was washed off. The curve given to represent the observations is altogether more regular than in the other cases, and the maximum was reached between 503° and 512° Fah., much lower than the corresponding point for the thin iron bowls.

If the vaporisation by the copper bowl No. VII. ·07 inch thick, be compared with that of No. II. of iron ·08 inch thick, it will be found to be much more considerable. In fact, the curve traced for the copper bowl is exterior to the curve for No. III., and at the temperature of about 540° Fah. intersects that for the iron bowl No. VI. ·18 inch thick. From 350° up to 508°, the time of vaporisation in the copper bowl varies from three-fourths of that in the iron bowl of the same thickness, to three-eighths of the time, at corresponding temperatures. The specific heat of the iron being slightly higher than that of the copper, bulk for bulk, would tend to keep up the temperature of the former metal, but the conducting power of the copper being more than double that of the iron, would much more than compensate for its lower specific heat.

14. The effect of a surface covered with a thick coating or scale of oxide, may be seen by comparing the dotted line near the full line for bowl No. VI. with the full line. At temperatures below 390° Fah. the scale of oxide diminishes the vaporisation considerably, probably by intercepting heat; but when repulsion begins to be developed, the scale acts to prevent it, and thus to raise the temperature of greatest vaporisation, and to diminish the time required for vaporisation at a given temperature. It will be recollected that this temperature of 390° differs but 7° from that found for the maximum vaporisation of drops from an oxidated surface.

This circumstance will be recurred to again.

Quantities of fluid, varying from one-sixteenth up to one-fourth of an ounce troy, were now used with a view to ascertain the effect of varying the quantity upon the temperature of maximum vaporisation. The surfaces were varied also. The results are given in the following table:—

Times of Vaporisation, at different Temperatures, of different quantities of Water in Bowl No. VI., three-sixteenths of an inch thick, in an oil bath.

Temperature. Fah°.	One-sixteenth ounce. Time in seconds.		One-eighth ounce. Time in seconds.		One-fourth ounce. Time in seconds.	
	Smooth.	Rough.	Smooth.	Rough.	Smooth.	Rough.
323						231
324	50					
325					234	
326		69	120	134		
353						134
354	23					
356			53	68	127	
357		28½				
386	11					
387						
388		10½	29			75
389				29		
390					78	
419	9					
420			20	22		
423		7½				
425						46
427					46	
450					38	38
452	8					
453		7				
454			18			
455						
460				15		
461						33
485	8					22
486		7	14			
489				10		
492					26	
502					24	
503			13 }			
504	7 M*		} M			
508		4 M				
511			13 }			
512				9		13 M
516					20	
517	8					
527						15
529					20	
534		5				
538	9					
544					19 M?	
546			15	8 M?		
548						15

An examination of this table shows no *proper maxima* of vaporisation; the differences in the times between experiments near the points of most rapid vaporisation being too considerable to indicate a true maximum in any case. Comparing, however, the temperatures of most rapid vaporisation as given by the table, for different quantities of water, we observe that the temperature of the metal, when water was thrown upon it, corresponding to most rapid vaporisation, which, with one-sixteenth of an ounce of water, was about 504°, was, with one-eighth of an ounce, about 507½°, and with one-fourth about 517°, having been raised but 13° by quadrupling the quantity of water, while the

* The letter M designates the temperature of maximum vaporisation.

extent of surface of the metal directly in contact with the water was doubled. At these points, in fact, the repulsion between the metal and water was considerable on first projecting both the sixteenth and eighth of an ounce of water into the bowl.

The effect of roughness of surface is to be seen in the three series; the effect at the lower temperatures seems to be generally to diminish the amount of vaporisation; and when repulsion would have taken place had the surface remained smooth to accelerate vaporisation at a given temperature, raising the point of greatest vaporisation on the scale. If this speculation be admitted, the temperature at which the rough and smooth surfaces vaporise equally, is but little above that of the real maximum of vaporisation of the metal when the cooling effect of the water is supposed to be entirely destroyed, that is, when the water is thrown upon it by small drops.

A comparison of the first and second series would place this point at about 386° Fah., the third and fourth at about 388½°. The fifth and sixth would leave a doubt of its position, placing it by the nearest of two results at about 424°; while, on the other hand, the near approach at a lower temperature would incline us to make the coincidence conform more nearly to the numbers given by the other series, by selecting two less accordant times, at about 388° Fah.

The experiments on drops of water placed the temperature of maximum vaporisation in this same bowl at 334° Fah. when the surface was smooth, and at 346½ when rough, no doubt a nearer approximation to the real point of maximum vaporisation than that just deduced by the medium of a considerable quantity of fluid.

15. No satisfactory method occurred of ascertaining the temperature of a small portion of a piece of metal of the thickness used in steam-boilers, and exposed to the action of water, at or below the boiling point, while it received heat from a constant source. It was deemed advisable, therefore, to compare the effects which would be produced by communicating heat through a very good conductor, such as tin in the solid or liquid state, and through an imperfect conductor and circulator, like the thickened oil employed in the foregoing series.

The same bowl was, therefore, tried in tin and in oil, with the same quantity of water, and with the following results, the bowl being ·25 inch thick (No. VIII.), and the material iron. The curves of observation are traced on fig. 2, plate 6.

Table of the Times of Vaporisation in different Baths.

Temperature.	One-eighth ounce. Time in seconds.		Remarks.
	Tin.	Oil.	
455	8¼	16	Bowl, No. VIII., ¼ inch thick.
465		12½	
473	7¼		
481		11¼	
491	6¼		
502		10½	
504	6		
513	6	10½	
521		10½	
537		10¼	
539	6¼		
555		9¼	
559	6⅞		
567	15½		
568		9½	
591	16		

The irregularity of the series made with the oil bath throws a doubt upon the maximum obtained, particularly as, with a thinner vessel, the preceding series gives a lower temperature as that of most rapid vaporisation, and the recurrence of the same time during a range of 19° confirms this doubt.

The temperature of greatest vaporisation in the tin was about 508½°, and the time but 6 seconds, while with the oil it was 9¼ seconds, as shown in this series, and probably less than 8, as shown in a foregoing series. The temperature of maximum vaporisation here given for the oil bath is 555°, differing 46½° from that for the tin. Some where between 559° and 568° the times of vaporisation are the same for each bath, the repulsion due to the greater heat communicated by the tin counterbalancing the diminished vaporisation from the less heat given by the oil.

This comparison shows that the thickness of metal at which the effect of the material of the bath, or means of applying heat, would vanish, is by no means reached in practice.

16. With a less thickness of metal, this difference in the nature of the bath was, of course, more striking. In a dish, one-twelfth of an inch in thickness, the vaporisation, in a bath of tin, compared with a series made with the same surface, in an oil bath, was as follows:—

Iron Bowl, No. II., 1-12th inch thick. 1-8th ounce water.			
Surface rough.			
In Tin.		In Oil.	
Temperature.	Time in Seconds.	Temperature.	Time in Seconds.
446°	7½	421°	71
460½	6	452	57
484	6¾	487	51
500	6½	507	47
554	8	517	44
566	8		

The average time of vaporisation in the oil bath is rather more than eight times that in the tin.

These experiments, therefore, do not entirely represent the case in practice where heat is communicated by flame, by contact of heated air, and by direct radiation.

The maximum shown by this table lies certainly between $460\frac{1}{2}°$ and $500°$; the apparent maximum being at $460\frac{1}{2}°$, the maximum given, by omitting the observation at $484°$, being about $468°$; and that by omitting the observation at $460\frac{1}{2}°$ being about $500°$.

The minimum time for the oil bath is obviously not reached; it will be recollected that this is probably as high as $570°$, or about fifty degrees higher than the last observation in the table.

The times of vaporisation for the tin bath, are nearly the same as those for the bowl of three-sixteenths of an inch thick. In fact, the heat may be considered as passing through a very thick tin bowl to the iron, and kept up by flame beneath a second iron surface; the modifying effect of an additional thickness of the iron bowl is therefore small.

Vaporisation of increased Quantities of Water.

17. It was now an object to increase the quantity of water introduced into the thickest of the iron and copper bowls until the limit of their respective capacities was reached, so that each part of the bowl to which the heat was applied should have also the cooling effects of the water upon it; the effects of the contact of a large quantity of water with hot metal would be thus represented. The nature of the results could not be expected to be otherwise than general.

For reasons already stated, the tin bath was used to communicate heat, and the projection of small particles of water from the dish was avoided by a rim of tin, which gave free escape to the steam, while it remedied, in a considerable degree, the difficulty just referred to. The temperature of the whole bath was in no case reduced very materially, a constant source of heat being applied below; but the metal which was near the bowl had its heat carried off faster than it could be supplied, and thus the temperature of the bath could show nothing more than the temperature of the bowl at the instant of projecting the water into it. The following remarks apply to the thickest iron bowl, or No. VIII., ·25 of an inch thick.

One half a fluid ounce of water reduced the temperature of the bowl from $417°$ to a little below $212°$, or through $205°$ Fah.

Three-quarters of an ounce, introduced at $504°$, cooled the metal of the bowl below the point of repulsion for drops, or through about 120 degrees, the higher temperature of the metal more than compensating for the increased quantity of water evaporated. This bowl contained, up to the level of the bath, nearly three and a half fluid ounces. The surface was oxidated.

The following remarks apply to the temperatures of the metal when the water was first introduced.

The temperature of maximum vaporisation for one-fourth of a fluid ounce, was above $480°$ Fah., but probably not very far. Between $569°$ and $628°$, the time of vaporisation of the same quantity of water increased from 10 to 20 seconds, or was doubled. The time at the point of maximum vaporisation was about 8 seconds. With one-half of an ounce of water the probable temperature of maximum vaporisation was about $504°$, and the time of vaporisation $11\frac{1}{4}$ seconds.

The different experiments which one fluid ounce of water, by comparison with a series in another bowl, indicated the temperature of maximum vaporisation to be as high as $555°$. At $518°$ and at $616°$ the times of vaporisation were nearly the same; namely, 16 seconds.

The temperature of maximum vaporisation, for two ounces, was above $600°$; at $580°$ and at $602°$, the times of vaporisation were the same; namely, 24 seconds.

This quantity was as great as the experiment could be made with satisfactorily.

From the results we see that the times of vaporisation of quantities of water in the ratio of $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 and 2, or of 1, 2, 4, 8, and 16, at the temperatures corresponding to the least time of vaporisation, were about as 6, 8, 11, 13, and 22, or as 1, $1\frac{1}{3}$, $1\frac{5}{6}$, $2\frac{1}{6}$, $3\frac{2}{3}$, not far from the ratio of the square roots of the quantities, which would have given 1, 1.4, 2, 2.8, 4.

The temperatures of the metal on which water being thrown will reduce it to such a degree, that the entire vaporisation shall take place in the least time, increased for quantities varying from one-eighth of an ounce up to 2 ounces, or sixteen times, from about $460°$ up to $600°$. The ratio of the temperatures above $212°$ was as 1 to about $1\frac{3}{5}$, indicating the approach to a temperature of the metal at which any large quantity of water introduced into a thick iron vessel would be vaporised most rapidly.

This point was elucidated directly by heating a cast iron bowl, half an inch thick, in a charcoal fire; this bowl was of the same figure, nearly, with those already described, it could contain about ten fluid ounces of water. When heated to redness, being still

kept on the fire, one fluid ounce of water was introduced, and lasted about 115 seconds: 4 ounces lasted in one experiment, 294 seconds; and in another, 304 seconds; and the red heat was not kept up in the dish: the water was repelled at first.

18. In the copper bowl, No. VII., the thickness being .07 inch, or about .36 of that of the iron, the following results were obtained, the same tin bath being used, and the surface of the copper being smooth.

At a temperature of 465½°, one-eighth of a fluid ounce of water was repelled, the repulsion being perfect nearly to the close of the experiment. This quantity required 175 seconds to evaporate. At the initial temperature of 501°, the same quantity required 187 seconds to vaporise it. At the higher of these temperatures, in an iron bowl of nearly the same thickness, but in an oil bath, the maximum of vaporisation was not reached.

One-fourth of an ounce required 13 seconds to vaporise it at 469° Fah., and 405 seconds at 529°, at which latter temperature the repulsion was perfect nearly throughout the experiment.

Three-eighths of an ounce vaporised in 12 seconds, at the initial temperature of 471°, and the metal in contact with the dish was solid. At the initial temperature of 486°, the same quantity required 30 seconds, and the repulsion was perfect for 15 seconds.

Five-eighths of an ounce vaporised in 15 seconds, at the initial temperature of 481°, and also at 509½°. The minimum time of vaporisation being, probably, between these temperatures.

One ounce vaporised in 22 seconds, at 465½°, as the initial temperature; in 16 seconds, at 486°, and the tin was found congealed beneath the cup; in 17 seconds, at 511½; the minimum time being probably between 486 and 511½.

Two ounces vaporised in 24 seconds, at 511½°, as the initial temperature; in 21 seconds at 526°, and in 22 seconds at 556½°; the minimum time of vaporisation being probably at or near 526° Fah.

From these results we see that between 471° and 486° Fah. $\frac{1}{4}$, $\frac{3}{8}$, $\frac{5}{8}$, and 1 oz. vaporised in times differing but little from each other, the range being from 12 to 16 seconds; and that with two ounces, from 511½° to 556½°, the time of vaporisation was about four times the least of those just referred to. With quantities of water, varying from one-eighth of what the part of the bowl which was in contact with the bath could contain, to one-half the capacity, the maximum vaporisation was between 471° and 481°, and 481°; and 511°, and the entire capacity of that part being filled, raised this temperature only to 526°.

This indicates the energy of the repulsion; for the evaporating surface being increased but about three times, and the water increased eight times, the initial temperature corresponding to the maximum of vaporisation was raised but '56°. It shows, further, that with metal at this temperature, eight times the volume of steam was formed in three times the time, when the entire capacity was filled and compared with one-sixteenth of this capacity filled; the quantity of 6121 cubic inches of steam, or nearly 3½ cubic feet having been generated in 42 seconds, at the initial temperature of 526°, the steam having atmospheric pressure.

The copper, which was bright when the experiments were commenced, became oxidated as they progressed, thus tending to raise the temperature of maximum vaporisation.

Conclusions.

19. From the foregoing details may be deduced the following general conclusions, which will be found of practical importance.

1st. The vaporising power of copper, when supplied with heat, by a bad conductor or circulator, such as oil, increases with great regularity as the temperature increases, up to a certain point, the water being supposed thrown upon the copper surface in small quantities. Copper flues, heated by air passing through them, would be in this condition if left bare of water, and then suddenly wet. This holds with copper one-sixteenth of an inch thick, without indication that a limit will be attained by a much more considerable thickness. The temperature at which the metal will have the greatest vaporising power, is about 570° Fah., or about 233° below redness, according to Daniell.

The law of vaporisation of small quantities of water, by a given thickness of copper, is represented with singular closeness by an ellipse, of which the temperatures represent the abscissæ, and the times of vaporisation the difference between a constant quantity and the ordinates.

2. The same power in thin iron, ·04 ($\frac{1}{32}$) inch thick, increased regularly, and was at a maximum, probably, at 510°. With thicker metal the power increases more rapidly at the lower temperatures, and varies very little,

comparatively, above 380°, with thicknesses exceeding one-eighth, and less than one-fourth of an inch; attaining a maximum at about 507° Fah., when the quantities are small; rising to 550°, and much above, as the quantity of water is increased relatively to the surface of the metal which is exposed. Quadrupling the quantity of water, the entire amount being still small, nearly tripled the time of vaporisation at the maximum.

3. When copper of one-sixteenth of an inch in thickness was supplied with heat by melted tin, a worse conductor, and having a lower specific heat than copper itself, the time of vaporisation, in a spherical bowl, of quantities varying from one-sixteenth to one-half of the entire capacity of the bowl, increased but three-fold, and the temperature of greatest evaporation was raised but 56°, or from 470° to 526°. When the bowl had half of the portion which was exposed to heat filled, the weight of the water was about one and one-tenth of that of the metal.

4th. The times of vaporisation of different quantities of water, varying from one-eighth of an ounce to two ounces, in an iron bowl one-fourth of an inch thick, and supplied with heat by the tin bath, were sensibly, as the square roots of the quantities, at the temperatures of maximum vaporisation for each quantity.

These temperatures were raised from about 460° to 600°, by increasing the weight of water about sixteen times, indicating that considerable quantities of water, thrown upon heated metal, will be most rapidly vaporised when the metal is at least 200° below a red heat.

5th. While a red heat, visible in daylight, given to a metal, even when very thick, and supplied by heat from a glowing charcoal fire, does not prevent water, when thrown in considerable quantities, from cooling it down so as to vaporise the water very rapidly, it is much above the temperature at which the water thrown upon the metal will be most rapidly evaporated. Thus one ounce of water was vaporised in 13 seconds, at about 550°, in a wrought-iron bowl one-fourth of an inch thick, and required 115 seconds to vaporise in a cast-iron bowl half an inch thick, at a red heat. Four ounces in the latter bowl vaporised in about 300 seconds, the bowl being red-hot when it was introduced; and two ounces vaporised in 34 seconds at 600° Fah.

6th. The temperature of greatest vaporisation, with a given thickness of metal, is lower in copper than in iron, the repulsive force being developed at a lower temperature. With equal thicknesses of iron and copper, the vaporising power of the latter metal, at its maximum, was, with the oil bath, one-third greater than that of the former, and with the tin bath the power of copper ·07 of an inch thick, was equal nearly to that of iron, one-fourth of an inch thick, each being taken at its maximum of vaporisation for the different quantities of fluid employed. As the maxima for the iron are higher than those for the copper, the advantage will be still greater in favour of copper when the two metals are at equal temperatures.

7. The general effect of roughness of surface is to raise the temperature at which the maximum vaporisation occurs, and to diminish the time of vaporisation of a given quantity of water at an assumed temperature below the maximum.

8. Though it has been shown that water thrown upon red-hot metal is adequate to produce explosive steam, even when it does not cool the metal down to the temperature of most rapid vaporisation, it is not the less true that metal more than 200° below a red heat, in the dark, is in the condition to produce even a more rapid vaporisation of water thrown upon it than when red-hot.

Stationary Temperature of Alcohol on heated Metals.

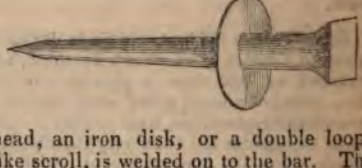
20. A curious fact was observed in regard to the temperature to which alcohol of the specific gravity ·81, containing, therefore, 93 parts of absolute alcohol and 7 of water, could be raised in a heated dish. It is necessary, as an introductory remark, to recall the fact, that when the temperature of a liquid is gradually raised, by applying heat to the vessel containing it, a limit is reached when the temperature of the liquid becomes stationary, the vapour given out in boiling carrying off the heat which enters the mass. When alcohol, of the strength above stated, was projected into a bowl heated above the temperature at which repulsion of the fluid takes place, the temperature of the liquid did not rise to its boiling point. In fact, the stationary temperature, instead of corresponding with that of ebullition, was lower as the temperature of the dish was higher. This experiment was made in the course of attempting to infer the probable temperature at which water might be repelled from the more readily attained temperature of the repulsion of alcohol. Not being of direct application to the subject before us, it was not carried as far as in other hands it would deserve.

Temperature of Alcohol vaporising in a Copper Dish, ·07 inch thick.			
Temperature of Dish.	Temperature of Liquid.	Time of Vaporisation in Seconds.	REMARKS.
381°	169½		Quantity thrown in not measured, nearly fills the dish.
396	165½		
418½ a 409½	165	65	
430 a 425½	164	72	
438	164	75	
445 a 440	163	85	One ounce of liquid.
441	159¼		
448	158¼		
"	158¾		
"	159¼		
453	157¼		

(To be continued.)

IMPROVEMENT IN SCYTHE SHARPENING.

Sir,—As the mowing season is at hand, I hasten to lay before you a few hints on the subject of scythes. The common scythes are formed of a plate of steel, increasing in thickness from the edge towards the back, like most other cutting instruments. The consequence of this formation is, that as the blade wears away in breadth, through use and sharpening, its edge becomes thicker and thicker, till the angle is too obtuse for the purpose of cutting. Razors have the same defect; to remedy which, a French cutler, some thirty years ago, made their blades of a thin piece of steel of one uniform thickness, and then backed them with a rib riveted on like a tenanting saw. A patent has lately been taken out in this country for making scythes on a similar plan; I have seen and handled them, and find that they answer very well. But the mowers complain of these patent scythes being dear, as they cost from seven to ten shillings each. Very few mowers, I should think, having a common scythe already of their own, would feel disposed, or, if disposed, be able to throw it aside to buy a patent one, after the fashion of the French razor. By the use, however, of a very simple contrivance, the edge of the common scythe may be kept as thin as desired until it is entirely worn out; and which little expedient I wish to suggest through the medium of your excellent publication; it is one that has been in use in Italy, time out of mind. Every mower in that country carries with him, conjointly with the whet stone, a little steel-faced hammer, and a little anvil. The hammer has a longish head, like those used for driving tacks, brads, &c. The anvil consists of a bar of iron, about one foot long. One end presenting a square surface of about an inch, faced with steel, and tapering to a point at the other end. At three or four inches below the



head, an iron disk, or a double loop-like scroll, is welded on to the bar. The bar, or anvil, being driven into the ground (the hardest bit at hand) can enter no further than the disk. The scythe being then laid with its edge flat on the anvil head, is beaten with the little hammer, so as to reduce it to that degree of thinness, which the wear and sharpening is continually depriving it of. An Italian mower performs this operation two or three times a day; and thus the blade is kept thin, and drawn out in breadth, for a long period of time. The anvil would, perhaps, be more conveniently portable, were the disk removable

from the bar. It might be of cast iron, about three inches diameter. A bit of stout sheet iron would be less liable to fracture.

I have the honour to be, Sir,

Your obedient humble servant,

F. Maceroni.

CIRCULATING DECIMALS.

Sir,—Mr. A. Peacock is surprised that none of your mathematical contributors have taken notice of a certain question proposed by him in your 18th volume, respecting circulating decimals, &c. I am afraid that this neglect has arisen from your mathematical friends not attaching so much importance to the subject as Mr. Peacock imagined it deserved. In No. 661, he proposes the question:—"Given ·3488372 + a part of a decimal circulating series; required the whole of the series, and its equivalent vulgar fraction." Mr. Peacock finds that $\frac{15}{43}$ will answer the conditions of the question. But is it the only fraction that can be found that will answer both conditions of the question? No, indeed; an infinite number of other fractions might be found that will satisfy the required conditions as well as $\frac{15}{43}$. Had Mr. Peacock limited the question to finding a fraction that has the fewest possible figures, then in some cases the answer might be obtained by the rule he has given, when the *decimal required to be produced is a pure circulate.* But when the *required decimal* ("save the mark!") *must be a mixed circulate,* the method of continued fractions recommended by G. C. L. of Kentish-town, gives a better chance of producing the vulgar fraction from which the decimal is to be produced; but even in it there is no certainty, for I shall tell both gentlemen that I have two different vulgar fractions in my mind's eye, the first of which produces a pure circulate, and the second a mixed circulate, and that the first seven decimal places of both are ·4256781. Could either gentleman tell me what were the fractions I had fixed upon? Certainly not. All that G. C. L. could do, would be to produce a series of vulgar fractions that are alternately greater and less than the given decimal, and ultimately he would produce a vulgar fraction exactly equal to the given *part of the fraction* ·4256781. The probability of Mr. Peacock's finding the required vulgar fraction, would be in the ratio of infinity to unity. In all the calculations I have ever met with, we must take the decimals as we find them; some are finite, others recur, whilst others go on to infinity, following no regular law. Decimals, however, of this last order, Mr. Peacock does not recognise, or rather he is doubtful of their existence. However, if he will try to extract the square root of 2, or, what is the same thing, to find the diagonal of a square whose side is 1, he will find that although he should pursue the operation to as many places of decimals as there are particles of matter in the planet Jupiter, he would be as far from producing a circulating decimal as when he began. Well, then, if the ratio of the side of a square to its diagonal cannot be expressed in finite arithmetical terms, is there any thing extraordinary that this should also be the case with the diameter and circumference of a circle? Mr. Peacock still, however, fancies that the exact ratio of the diameter to its circumference may be obtained from some of the fanciful properties which he anticipates will be manifest when a better knowledge of circulating decimals is acquired! For his benefit, as well as all others whom it may concern, I shall give the following quotation from the writings of that eminent philosopher and mathematician, the late Sir John Leslie:—

"The squaring of the circle is a problem which has at all times fascinated the attention and bewildered the reason of many superficial or antiquated students in geometry.

* * * * *

"The incommensurability of the circle, which James Gregory had attempted to prove in 1661, was finally demonstrated a century afterwards by Lambert, from an ingenious transformation of the known series for the quadrantal arc in terms of the radius," &c.

I am, Sir, respectfully,

Your obedient servant,

A Country Teacher.

May 16, 1836.

NOTES AND NOTICES.

Potatoe Beer.—A professor of chemistry at Prague has succeeded in producing a very excellent kind of beer from potatoes, clear as wine, pleasant to the taste, and strong.

A Walking-Stick, recently presented to Mr. Sopwith, surveyor, of this town, contains, in the dimensions of an ordinary cane, the following materials:—Two inkstands, pens, pen-knife, ivory folder, Lucifer-matches, sealing wax and wafers, a wafer-stamp, wax-taper, several sheets of post letter-paper and card-paper, a complete and highly-finished set of drawing-instruments, ivory rule and scales, lead and hair pencils, Indian-rubber, Indian-ink, a thermometer, and a beautiful and well-poised magnetic compass; the whole so arranged as to admit any instrument being used with facility. —*Newcastle Paper.*

New Carriage-Warmer.—Dr. M'Williams, of this city, has taken out a patent for a stove for heating carriages of all kinds, which is one of the most valuable inventions which has ever been made. It is remarkable in its structure, and may be sold for 6 or 8 dollars; and it consumes the most inconsiderable quantity of coal. The advantages of such a stove are almost too obvious to be mentioned. Taking up very little room, they may be fitted to the bottom of gigs or chaises, and of every variety of carriage, and are particularly well adapted to railroad-cars. The expense of fuel is not above 3 cents for 100 miles travelling, at an ordinary rate. It is only necessary to make this invention known, to secure its introduction very generally. For a trifling expense, a stage-driver may now be as comfortably situated on his box, as by the by-room fire; and the pleasures of sleigh-riding may be enhanced a hundredfold. This stove is now used in the cars of the Baltimore and Washington Railroad, and gives entire satisfaction. The passengers are kept warm during the whole journey, and are never annoyed by smoke, the stove being air-tight.—*Washington Mirror.*

Ploughing by Steam.—Some experiments were lately tried at Red Moss, near Bolton, in the presence of Mr. Handley, M. P. for Lincolnshire, Mr. Chapman, M. P. for Westmeath, and other gentlemen interested in agriculture, with a new and very powerful steam-plough, constructed by Mr. Heathcote, M. P. for Tiverton. About 6 acres of raw moss were turned up in a few hours, in the most extraordinary style,—sods 18 inches in breadth, and 9 inches in thickness, being cut from the furrow, and completely reversed in position, the upper surface of the sod being placed exactly where the lower surface had been before. * * * The plough of Mr. Heathcote, though a very powerful machine, appears to us to be much too complex and costly for common agricultural purposes; though we have little doubt that it might be used not only with effect, but with advantage, in reclaiming large portions of moss land, such, for instance, as the bogs of Ireland. Indeed, it is the opinion of Mr. Heathcote himself, that it would not at present answer to employ it in reclaiming a smaller portion of bog than 1,500 or 2,000 acres, though it may probably be cheapened and simplified so as to make it ultimately useful on a smaller scale.—*Liverpool Paper.*

Railroads in the United States.—It is estimated, on good authority, that at this time the railroads in the United States, either actually under contract or in progress of being surveyed, amount to more than 3,000 miles. Each yard of the highest iron rails, fit for a railroad, weighs 62½lbs. As there are 1,760 yards in a mile, each mile of railroad, with a double track, will require 238 tons of rails, besides chains, screws, and bolts—amounting, in the whole, to at least 250 tons of iron per mile—250, multiplied by 3,000, is 750,000 tons of iron, that will shortly be used in the United States in the construction of railroads. Such is the demand for railroad iron in England for the American market, that common bar-iron, which one year ago was worth only 6*l.* 10*s.* sterling in Wales, is now worth 9*l.* 10*s.* at the Welsh works, as appears by the British Prices Current. It is stated in the New York papers, that at this time contracts have been actually made in England, by American houses, for 400,000 tons of railroad iron to be shipped to this country.—9*l.* 10*s.* sterling is about 45 dollars of our money; but railroad-iron costs more than common bar-iron, and is at this time worth at least 50 dollars per ton, at the works in Wales or Staffordshire. Four hundred thousand tons of iron, at 50 dollars per ton, is *twenty millions of dollars,* that the people of the United States are bound to pay to the English by their present contracts for railroad-iron. If all the projected railroads of this country shall be laid down with British iron rails, we shall pay to the English nation, within the next seven years, at least *fifty millions of dollars for railroad-iron.* And yet we have in our mountains both iron ore and coal, of the best quality, and in quantities sufficient to yield iron for the whole world.—*American Railroad Journal.* — [Another interesting article on this subject will be found in a preceding page.—Ed. M.M.]

Introduction of Burden's Boat into France.—Baron Seguier, Member of the Institute, has constructed a boat after the plan of Burden's, of two double cones, 100 feet long, with the engine between them, which, with the boiler, presents some improvements. M. Cave, a mechanical engineer, has also constructed a double boat, for the navigation of the canal of Somme. It differs from the preceding in being open at the surface, covered with a flooring, and has two keels and two helms. A similar boat has been constructed for the navigation of the Loire, between Nantes and Angers. —*Bul. Soc. Enc. l'Ind. Nat.*

J. H. labours under a popular error. As we have before mentioned, there is no reward offered for the discovery of perpetual motion.

Mr. Henderson's paper is left with our publisher for him.

Communications received from Mr. Etrick—Campo bello—Zeta—Mr. J. Wilbee.

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C.E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

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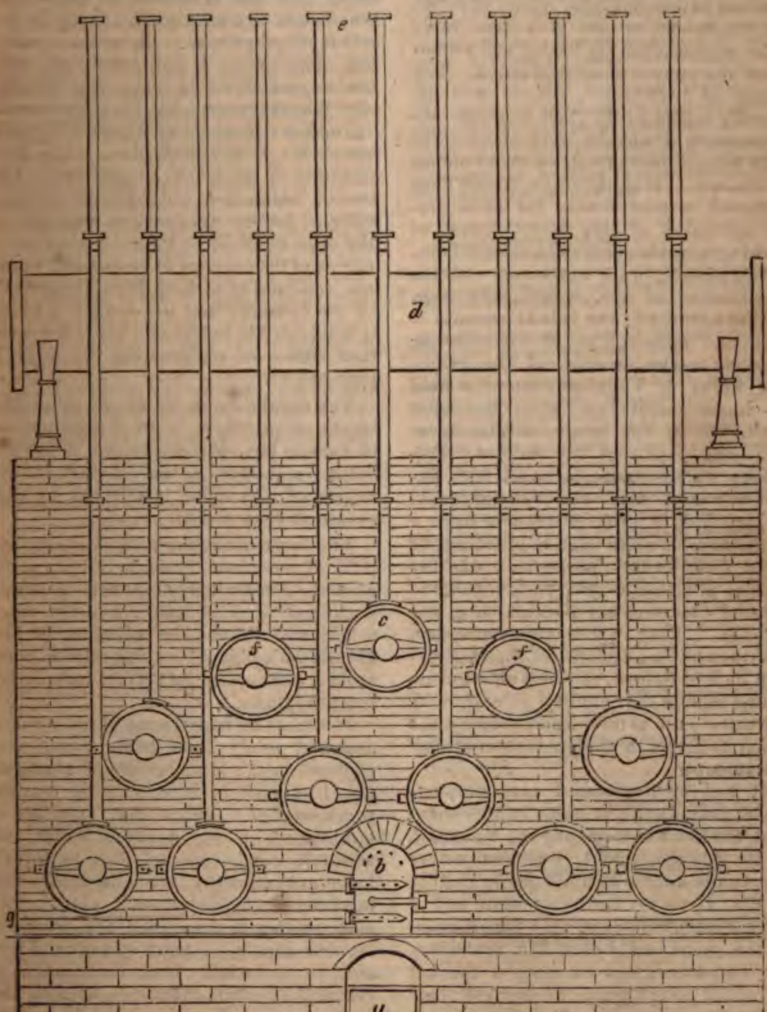
HUTCHISON'S PATENT RETORT-BED.



HUTCHISON'S PATENT RETORT-BED.

Sir,—There is no part of the extensive machinery employed in the manufacture of coal-gas that has undergone so many changes and alterations as the retort; every variety of shape that could possibly be adopted has been tried—and large sums have at various times, during the last twenty years, been thrown away in securing patent rights for retorts of different forms—under the idea that their make or proportion facilitated and economised the process of carbonisation. The names of individuals, greatly and deservedly esteemed for their scientific acquirements, could be mentioned, who have wasted their talents and their money in this way. Had the same labour been bestowed in ascertaining the most proper method of placing retorts, instead of devising new shapes for the retorts themselves, science, in its connexion with the manufacture of gas, would have been further advanced than it is at present.

It had occurred to Mr. Hutchison, previous to the erection of the extensive works at Vauxhall, that the field for improvement lay not in the retort itself, but in the mode of placing or arranging them over the furnace. Following up this opinion, he at once hazarded a bold, and, what was considered at the time, a rash innovation upon a principle which had been in operation for more than twenty years; this was the placing of eleven retorts (each capable of holding four bushels of coals) over one furnace. The experiment succeeded, and thereby was established the expectation he had formed, of being able to carbonise double the quantity of coal, with the same bulk of fuel consumed by the usual principle in the production of *half* the amount.

It was chiefly, and, I may say, entirely, through this valuable improvement that the London Company at Vauxhall, at its commencement, was enabled to supply the public with a superior quality of gas, at 40 per cent. less than any of the old establishments. By the adoption of the retort-bed which Mr. Hutchison has introduced, not an atom of the hot air which issues from the furnace is allowed to pass into the atmosphere; every particle is effectively used in the process of carbonizing; whereas, on the contrary, one-half of the heat generated in retort-beds, constructed on the usual plan, passes immediately into the main shaft, without having rendered any service whatever. Surely this is a circumstance which demands the serious consideration of engineers who are interested in the prosperity of gas-works. A knowledge of the fact, that a body of heat which may safely be valued at some thousands of pounds annually, is unappropriated and completely lost in nearly all gas-works, is sufficient to create much anxiety in the minds of proprietors. So great a sacrifice of property, I am persuaded, will not be permitted to exist any longer, now that the remedy has been discovered.

Another advantage which arises from the use of Mr. Hutchison's plan, is the preservation of the retorts themselves. The iron of which they are made when in a state of perfect ignition, is exposed to the most rapid decay from the destructive effects of the currents of heated air, which are continually rushing from the nostrils of the furnace; and this is an evil which it is impossible to obviate, while the common system of constructing the flues is persisted in.

The durability of retorts set upon the improved principle, is in the proportion of four to one, in comparison to the old method:—hence, a vast saving in the article of iron alone is effected by this excellent contrivance.

The large establishments of the metropolis expend from 2000*l.* to 3000*l.* each, annually, in replacing retorts. A diminution of at least half the above sums would ensue from the adoption of Mr. Hutchison's plan of setting retorts upon arches, surrounded by perfect reverberating draughts.

It is after an experiment of some years, acquired solely from being practically engaged in the manufacture of coal-gas, that I have presumed to state my opinion so unreservedly against that principle of building retort beds, which far better, and certainly much superior, men to myself have professionally recommended—and in favour of Hutchison's plan. My only motive in soliciting the insertion of this article in your scientific Journal, is to benefit Gas Companies in general, by communicating through the medium of a widely-circulated Magazine a knowledge of an improvement which, if universally adopted, must undoubtedly enhance to an important extent the value of gas property.

Description of the Engraving.

The retorts *c*, shown in the accompanying sketch, are so arranged that their relative positions with respect to the furnace *b*, subject all of them to one uniform and undeviating degree of heat. The hot-air flues or nostrils, which proceed vertically and horizontally from the furnace, communicate with revolving draught-channels which surround the retorts. These flues, from the circular direction in which they are conveyed to every part of each retort, transmit with perfect uniformity all the heat which rushes from the various openings in the furnace. The temperature is by this arrangement preserved in a continual state of perfect equability; and in consequence the heated metal is not exposed to the destructive action of the heated air which passes through the furnace. The retort, also, being completely surrounded by flues, is protected from that damage to the iron which result from the action of cutting draughts. The heat, after having circulated through the longitudinal semi-cylindrical cases of brick-work which enclose the lower tiers, is conveyed through lateral openings, at uniform distances on each side of the extremities of the bed; from whence the two draughts ascend, and unite immediately under the crown of the fire-arch, which is built over the upper range of retorts. The heat coming into immediate contact with this arch, reverberates to the horizontal flues; and instead of escaping into the shaft (according to the old principle), it exhausts itself throughout the interior ramifications of the bed.

CLOVIS.

London, April 22, 1836.

GUTZLAFF'S CHINESE MAGAZINE, VOL. I.

東西洋考每月統記傳

Our readers will recollect that a short notice of the first Number of this interesting miscellany appeared in the *Mechanics' Magazine* of May 17, 1834 (No. 562, vol. xxi.) A complete volume of it has since come under our inspection; and we perceive that a second has appeared in China, the country of its publication. In our opinion, the work is one which, although not quite on a par with the best periodicals of London and Edinburgh, deserves to be a favourite with the lovers of light reading in Pekin and Canton; but we regret to observe, that a native critic of some authority has expressed an opposite opinion. As the gentleman we allude to, Taou Kwang by name, holds the highly respectable and lucrative situation of Emperor of China, and has thought fit to publish his unfavourable opinion of the work in a proclamation addressed to the Viceroy of Canton, commanding him to show no mercy to the villains who are accelerating the march of mind in his dominions by printing and publishing this abominable "Maga," we were somewhat apprehensive that it might become and remain a "stuck-work;" but the Branch Society for the Diffusion of Useful Knowledge established at Canton has since, we observe, resolved, with the usual attention of his English *visitors to* the wishes of his *Celestial Majesty, to take* the Magazine under its especial protection, and guarantee its further continuance. Under such auspices it may, in due time, become as great a nuisance to the Government of China, as the "great unstamped" have been to the Government at home.

On thus learning what a sensation this apparently harmless miscellany had produced in an emperor, at least, if not in his subjects, we turned over its pages with some interest, to ascertain what it could possibly be that had given so much offence. The ordinary contents of the Numbers seem, at first sight, not very alarming. Several pages in each are occupied with fragments of a long article on the "Comparative History of the East and West," in which a parallel is drawn between Fo-Hi and Noah, the Chinese deluge and that recorded in Genesis, &c. Another invariable article is the news of the month; chiefly the news from Western Asia and Europe. The Chinese may perhaps take some interest in the short account which is given of the struggle between Don Miguel and Donna Maria, since its results produced changes in Macao which passed under their own eyes; but the notices we find here of the separation of Holland and Belgium, the war between the Pacha of Egypt and Sultan Mahmoud, and divers other events of the first importance to European readers, will, we suppose, be

NOTES AND NOTICES.

Potatoe Beer.—A professor of chemistry at Prague has succeeded in producing a very excellent kind of beer from potatoes, clear as wine, pleasant to the taste, and strong.

A Walking-Stick, recently presented to Mr. Sopwith, surveyor, of this town, contains, in the dimensions of an ordinary cane, the following materials:—Two inkstands, pens, pen-knife, ivory folder, Lucifer-matches, sealing wax and wafers, a wafer stamp, wax-taper, several sheets of post letter-paper and card-paper, a complete and highly-finished set of drawing-instruments, ivory rule and scales, lead and hair pencils, Indian-rubber, Indian-ink, a thermometer, and a beautiful and well-poised magnetic compass; the whole so arranged as to admit any instrument being used with facility. —*Newcastle Paper.*

New Carriage-Warmer.—Dr. M'Williams, of this city, has taken out a patent for a stove for heating carriages of all kinds, which is one of the most valuable inventions which has ever been made. It is remarkable in its structure, and may be sold for 6 or 8 dollars; and it consumes the most inconsiderable quantity of coal. The advantages of such a stove are almost too obvious to be mentioned. Taking up very little room, they may be fitted to the bottom of gigs or chaises, and of every variety of carriage, and are particularly well adapted to railroad-cars. The expense of fuel is not above 3 cents for 100 miles travelling, at an ordinary rate. It is only necessary to make this invention known, to secure its introduction very generally. For a trifling expense, a stage-driver may now be as comfortably situated on his box, as by the by-room fire; and the pleasures of sleigh-riding may be enhanced a hundredfold. This stove is now used in the cars of the Baltimore and Washington Railroad, and gives entire satisfaction. The passengers are kept warm during the whole journey, and are never annoyed by smoke, the stove being air-tight.—*Washington Mirror.*

Ploughing by Steam.—Some experiments were lately tried at Red Moss, near Bolton, in the presence of Mr. Handley, M. P. for Lincolnshire, Mr. Chapman, M. P. for Westmeath, and other gentlemen interested in agriculture, with a new and very powerful steam-plough, constructed by Mr. Heathcote, M. P. for Tiverton. About 6 acres of raw moss were turned up in a few hours, in the most extraordinary style,—sods 18 inches in breadth, and 9 inches in thickness, being cut from the furrow, and completely reversed in position, the upper surface of the sod being placed exactly where the lower surface had been before. * * * The plough of Mr Heathcote, though a very powerful machine, appears to us to be much too complex and costly for common agricultural purposes; though we have little doubt that it might be used not only with effect, but with advantage, in reclaiming large portions of moss land, such, for instance, as the bogs of Ireland. Indeed, it is the opinion of Mr. Heathcote himself, that it would not at present answer to employ it in reclaiming a smaller portion of bog than 1,500 or 2,000 acres, though it may probably be cheapened and simplified so as to make it ultimately useful on a smaller scale.—*Liverpool Paper.*

Railroads in the United States.—It is estimated, on good authority, that at this time the railroads in the United States, either actually under contract or in progress of being surveyed, amount to more than 3,000 miles. Each yard of the highest iron rails, fit for a railroad, weighs 62½lbs. As there are 1,760 yards in a mile, each mile of railroad, with a double track, will require 238 tons of rails, besides chains, screws, and bolts—amounting, in the whole, to at least 250 tons of iron per mile—250, multiplied by 3,000, is 750,000 tons of iron, that will shortly be used in the United States in the construction of railroads. Such is the demand for railroad iron in England for the American market, that common bar-iron, which one year ago was worth only 6*l.* 10*s.* sterling in Wales, is now worth 9*l.* 10*s.* at the Welsh works, as appears by the British Prices Current. It is stated in the New York papers, that at this time contracts have been actually made in England, by American houses, for 400,000 tons of railroad iron to be shipped to this country.—9*l.* 10*s.* sterling is about 45 dollars of our money; but railroad-iron costs more than common bar-iron, and is at this time worth at least 50 dollars per ton, at the works in Wales or Staffordshire. Four hundred thousand tons of iron, at 50 dollars per ton, is *twenty millions of dollars*, that the people of the United States are bound to pay to the English by their present contracts for railroad-iron. If all the projected railroads of this country shall be laid down with British iron rails, we shall pay to the English nation, within the next seven years, at least *fifty millions of dollars for railroad-iron.* And yet we have in our mountains both iron ore and coal, of the best quality, and in quantities sufficient to yield iron for the whole world.—*American Railroad Journal.* — [Another interesting article on this subject will be found in a preceding page.—ED. M.M.]

Introduction of Burden's Boat into France.—Baron Seguier, Member of the Institute, has constructed a boat after the plan of Burden's, of two double cones, 100 feet long, with the engine between them, which, with the boiler, presents some improvements. M. Cave, a mechanical engineer, has also constructed a double boat, for the navigation of the canal of Somme. It differs from the preceding in being open at the surface, covered with a flooring, and has two keels and two helms. A similar boat has been constructed for the navigation of the Loire, between Nantes and Angers. —*Bul. Soc. Enc. l'Ind. Nat.*

J. H. labours under a popular error. As we have before mentioned, there is no reward offered for the discovery of perpetual motion.

Mr. Henderson's paper is left with our publisher for him.

Communications received from Mr. Etrick—Campo bello—Zeta—Mr. J. Wilbee.

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C. E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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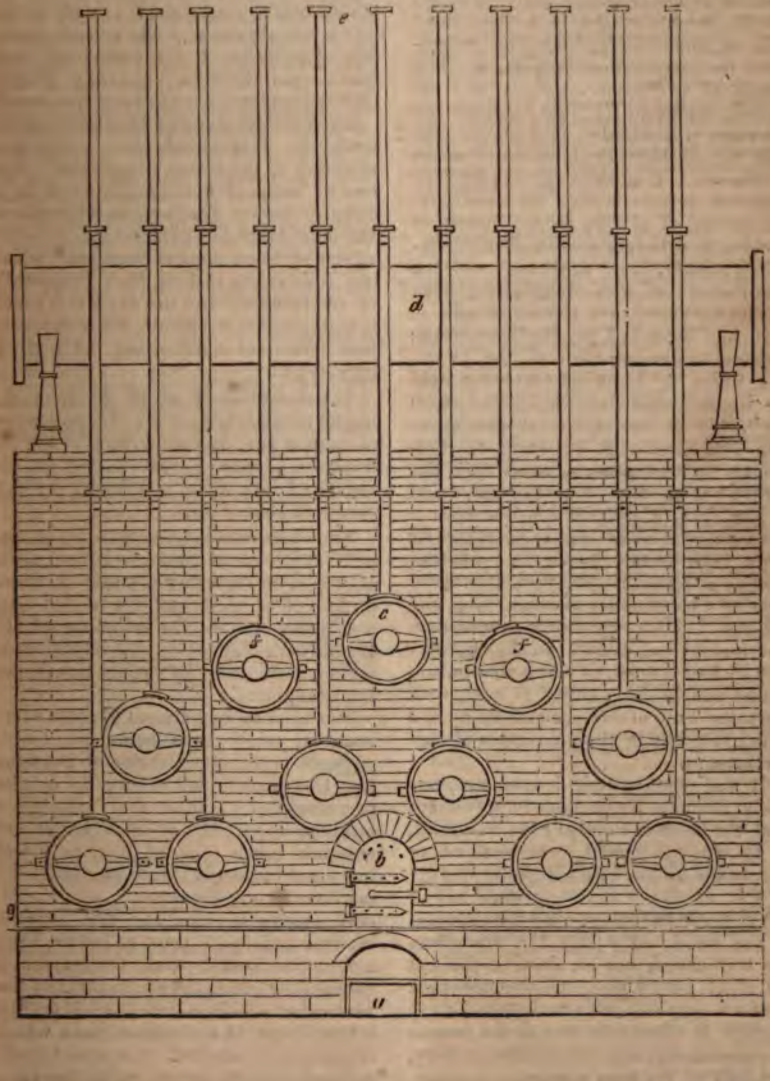
HUTCHISON'S PATENT RETORT-BED.



In the European process, sulphuric acid was for a long time made use of to effect the saccharification, and it is only within these few years that it has been discovered that germinated barley would produce the same result. This simple modification has produced a very great saving in the manufacture, which is now taking an immense development by the mixture of syrups of starch with the molasses of commerce, and other applications. All this process was pointed out in the Chinese encyclopedias, which I have already mentioned." * * * "With regard to agriculture, it is from China that we have received the sowing-machines, which have been known there from a remote antiquity." It was to make other discoveries of this kind that Mr. Edward Biot applied himself to study the Chinese encyclopedias which exist in the Royal Library of Paris, where there is a superior collection to that in the British Museum, including especially the celebrated work of Ma-twan-lin, of which we regret to say there appears to be as yet no copy in this country. The *Japanese Cyclopedia*, to which we gave much attention, is, however, merely an improved edition of the San-Tsae-Too-Hwuy, or "Collection of Pictures of the Three Elements" (三才) i. e. heaven, earth, and man; which is to be found at the Museum, or may be bought at Mr. Allen's, in Leadenhall-street, in 63 vols. large 8vo. in six cases, for 25*l*. This work, which is tolerably complete, including, for instance, under the head of architecture, representations of every kind of building, from a palace to a pig-stye, and giving instructions even in boxing, with representations of the Chinese "fancy" in their different attitudes of "coming to the scratch," is, in our humble opinion, by no means the work to be chosen for a purpose like Mr. Biot's. The letter-press is nearly balanced in quantity by the plates (which are by no means of the very best kind), and relying on this, the descriptions have been made too brief and cursory to aid research. In fact, Mr. Biot himself observes, that "the expressions employed are often very vague, and the indications given by the text are rather sufficient to enable me to recognise a process since discovered in Europe than to pursue it from the description." In consequence of this, the praiseworthy researches of this worthy inheritor of a distinguished name, do not appear to have led to any important results. He concludes his essay thus—"From the extracts that I have given from several Chinese works, it will be seen that in the seventeenth century, at the period when the missionary establishments were flourishing in China, a judicious selection of articles from these works would have propagated useful ideas in Europe, and the discovery of some processes of industry might have been advanced by more than half a century" (this refers to some improvements in the smelting of metals). "But these works are now too old in a technological point of view, since they date back two centuries and a half, and we should hope that the spirit of invention and detail, which has produced among the Chinese so many important discoveries, has not been stifled by their political system. With regard to the development that the sciences might have taken amongst them, no hopes can be entertained by those who have perused their modern works in astronomy, such as the Hwan-tëen-too-shwo, or "Description of the Celestial Sphere," a work published in 1820 at Canton, under the inspection of the Viceroy, and in which astronomy takes a retrograde march further back than the knowledge attained at the time of Ptolemy. The only instrument mentioned in it is the gnomon of stone which was employed in the infancy of astronomy. But new works on the arts of China would, without any doubt, have given us useful hints on the modern manufacture of gongs, of Chinese paper, of colours, and of other objects which I cannot here enumerate." These new works would, it appears, in vain be sought for at Paris, but there does not seem to be any difficulty in procuring them at Canton, and it is there that they might best be translated. Mr. Biot mentions a supplement to the great work of Ma-twan-lin, bringing it up to a recent period, which it must be owned was by no means unnecessary, when we consider that the original author flourished in the beginning of the 13th century, at the time the Mongol Tartars conquered China and Russia. There could not be a more valuable present made to the literature of Europe than a translation of this great work and its supplement; and if this

Number of the *Mechanics' Magazine* should ever meet Mr. Gutzlaff's eye, we would earnestly press on his attention the power he possesses of immortalising his name by a work of such colossal interest and utility.

In the mean time, in spite of all our deference for our learned brother-reviewer in China, we cannot help saying to the magazine, "Go on and prosper."

JONES' SPARK-ARRESTER.

(From the *Journal of the Franklin Institute.*)

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, to whom was referred for examination an apparatus for stopping the sparks from the flues of locomotive-engines, invented by Mr. Alfred C. Jones, of Portsmouth, Virginia, report:—

That it has for some time been considered a desideratum to devise a plan by which the sparks escaping from the chimney, or smoke-pipe, of a locomotive-engine, may be arrested, so as to ensure both the comfort of passengers and the safety of goods transported on railroads. The rapid extension of this mode of conveyance is every day rendering this object of increased importance. Judging from the certificates of engineers and others, exhibited by Mr. Jones, it may be inferred that he has been more successful in relation to it than preceding inventors.

The principal peculiarities of Mr. Jones' invention are the following:—

1. A projection, and funnel-shaped opening, in the front part of the wire-gauze, which surmounts the smoke-pipe. This opening is for the purpose of admitting the external air to mix with the escaping smoke and steam, and is supposed to have the double effect of cooling and condensing the smoke and steam, so that it will not burn and destroy the wire-gauze, and of producing a horizontal or backward current of air, which throws the sparks into the receptacle hereafter described.

2. A peculiar shape in the wire-gauze cap, extending a considerable distance backward, over or beyond the back of the top of the smoke-pipe, which affords a space for the sparks to be thrown down into the receptacle hereafter described, the shape of the back part of the cap, or wire-gauze, being such that the sparks do not strike it perpendicularly, but obliquely to its surface, and thus are thrown down instead of passing through the apertures.

3. A receptacle for sparks, back of the top of the smoke-pipe, and under the back part of the gauze-cap, at the lower part of which receptacle is a pipe, extending downward into the smoke-chamber at the end of the boiler, and below the part immediately connected with the boiler. Through this pipe the sparks pass, and fall into the bottom of the smoke-chamber. It is supposed by Mr. Jones, that the impetus of the steam, escaping from the engine through the smoke-pipe, produces a partial vacuum in the bottom of the smoke-chamber, and causes a portion of air to rush down the said pipe, which makes the sparks more readily descend to a place where they are beyond the influence of the escaping current of smoke and steam, there to be consumed.

4. The gauze-cap is made with hinge-joints, so as to be thrown over backward when the engine is not under way. This contrivance serves the double purpose of preventing the gauze from being clogged with lamp-black, by the thick smoke escaping before the starting of the engine; and of facilitating the cleansing of the gauze, by a brush applied to its inner surface, where the smoke and lamp-black condenses.

It is the opinion of the Committee that each of the foregoing features is productive of advantage. Hence, they are of opinion, that Mr. Jones' apparatus is among the best that has been devised; an opinion which is confirmed by the respectable testimony which has been adduced.

There is a suitable apparatus for arresting the sparks when the engine is going backward, which it is deemed unnecessary here to describe.—By order of the Committee,

WILLIAM HAMILTON, Actuary.

Jan. 14, 1836.

REPORT OF A COMMITTEE OF THE CITY COUNCIL OF BALTIMORE, APPOINTED TO WITNESS CERTAIN EXPERIMENTS UPON THE POWER OF THE LOCOMOTIVE ENGINES EMPLOYED ON THE BALTIMORE AND OHIO RAILROAD.

(From the *American Railroad Journal.*)

The Joint Committee of the City Council of Baltimore, appointed to witness experiments upon the power of the locomotive-engines, on the Baltimore and Ohio Railroad, at the inclined planes, respectfully report:—

That your Committee left Baltimore on the morning of Tuesday last, accompanied by a Committee of the Board of Directors of the Company, a Committee of the Board of Trade, and other individuals, in all amounting to 42 persons. The train consisted, besides the engine and its tender, of a double 8-wheeled passenger car, constructed to accommodate 44 persons, and three 4-wheeled passenger cars, capable of containing 17 each. After some delay, occasioned by coming in contact with the

leaders of a burden team, who being alarmed, sprung before the engine from off the adjoining track, the train arrived at the foot of plane No. 1, at the distance of 42 miles from Baltimore. The instructions given to the engineer had been, as your Committee are informed, to stop here, and, disengaging the double car, to attach the three single cars to the engine, and to ascend the planes with them, and with 50 passengers, this being a demonstration of the power of the engine, which, it was believed, would satisfactorily prove its efficiency for use, where the elevation was at the rate of 200 feet per mile. Confident, however, in the power of the engine, the engineer, without stopping at the foot of the plane, commenced its ascent, with the train that had left Baltimore. The impetus acquired on the level, was lost in the first 300 feet of the ascent, after which, the engine drew its load steadily to the summit of the first plane, at the rate of from four to five miles an hour, accumulating speed as it approached the top. This plane is 2150 feet in length; 2050 feet of which ascend at the rate of 197 feet per mile, and 100 feet at the rate of 201 feet per mile. From the first plane the train proceeded to the second, which is 3000 feet in length; 2800 feet of which ascend at the rate of 170 feet per mile, 100 feet at the rate of 227 feet per mile, and 100 feet at the summit, at the rate of 264 feet per mile. The engine and its train ascended at the rate of from 5 to 6 miles per hour, to within 30 feet of the summit of this plane, when, while on the grade of 264 feet to the mile, it stopped. The three small cars, weighing 5 ton 100 weight, were then cast loose, when the engine starting, without assistance, on this grade, drew the double car and passengers to the summit with the greatest apparent ease. The steam escaped in volumes from the safety-valve, as well when the engine reached the summit of the planes, as when it left the foot of them. The weight drawn up the planes was as follows, according to actual weighing:—

Paterson	1	10	2	0
Patapsco	1	15	2	0
Carroll	1	15	2	0
Double Car	4	17	0	0
45 Passengers	3	0	0	0
Tender	4	7	0	0
Tons	17	5	0	0
Engine	8	10	0	0
Making a gross weight of	25	15	0	0

This weight of 25 tons 15 cwt. was drawn up the grades before-mentioned, the steepest of which was 227 feet per mile, with much ease, and by the inherent power of the engine, without the assistance of the *impetus of previous high speed*—and the weight of 20 tons 15 cwt., deducting from the above the weight of the three cars cast off on plane No. 2, was drawn with equal ease up a grade of 264 feet to the mile,—the engine starting the train from rest on this grade. At the summit, two car loads of pig iron, weighing each 4 tons, were attached to the train, and the whole, weighing then 33 tons 15 cwt., was made to descend the plane, on the return to Baltimore, by the action of the engine alone, and without the assistance of a break, at such speed as the engineer pleased, and was several times stopped, on the way down, to show the command in which the engine was held.

With such results as the above, it is unnecessary to add, that your Committee are equally gratified and surprised; and from what they themselves witnessed, they have no hesitation in expressing their conviction, that the engines of the Baltimore and Ohio Railroad are capable of drawing with ease, at least 50 passengers, up ascents of any length, of from 200 to 220 feet per mile.

From the account thus given, it will be at once seen, that the performances of the best engines in England have been far surpassed; and although your Committee are aware, that calculation was competent to prove the practicability of ascending grades like those at the planes, with engines of the weight and power used on this occasion, and with similar loads, yet it was reserved for the company in question to prove that machines of such giant power could be constructed, combining with their great strength, the important qualities of speed, durability, facility of repair, and capability to use anthracite as their fuel.

Your Committee are glad to have an opportunity of expressing their sense of the obligations, which the efforts of the Baltimore and Ohio Railroad Company have conferred upon the railroad system generally, and more especially in reference to it, as connected with the city of Baltimore. It is now a matter of common parlance to assert, that the Alleghanies can be passed by locomotive-engines, by the Potomac route, without the use of stationary power; and your Committee entertain no doubt of the fact. It is this which gives to Baltimore the vantage ground, in the competition with her sister cities, for the western trade; and yet this is owing, not more to the geographical depressions of the mountain range, than to the engines perfected by the company just named. Excepting the engines manufactured by them, there is probably not one in the United States, although some of the best ever made in England have been imported, which is capable of ascending the grades and passing the curves for any profitable purpose, which must occur among the mountains on the road in question. While nature, therefore, has

done much to facilitate the intercourse of Baltimore with the west, the Baltimore and Ohio Railroad Company has not done less.

Your Committee make these remarks as an act of justice; and they do it with the more pleasure, because it enables them to bestow a deserved compliment upon the American mechanics, who have so well illustrated their capacity and skill in the manufacture of the engines in question—proving, satisfactorily, that in this, as well as in the other departments of human industry, their inventive genius is capable of the most elevated and useful flights. It is now but a few years since the universal voice called upon the Baltimore and Ohio Railroad Company to follow the example of their neighbours, and import their engines; and their perseverance in refusing to do so, although founded upon the very best and truest appreciation of circumstances, was stigmatised as folly or obstinacy. The result has fully justified their course, and showed that their confidence in the skill of the artisans of this country to produce a more perfect machine than had yet been manufactured in England, and better adapted to the road from Baltimore to the Ohio, was fully warranted.

The capacity of a locomotive-engine, when employed in heavy drafts, depends upon three things:—1st. Its weight, which gives it the adhesion on the rails that is requisite; 2nd. The capacity of its cylinders to use the adhesion to its utmost limit; 3rd. The ability of the boiler to supply the cylinders with steam equal to their capacity. Where the power is applied to but one pair of wheels but half the adhesion is used, supposing the weight to rest equally on the four wheels. Where the power is applied to both pair, the weight of the whole engine is made effective to produce adhesion. The English engines generally have but one pair of wheels geered. The engines of the Baltimore and Ohio Railroad Company have both pair geered. The weight of the engines, therefore, being equal, and there being enough steam to overcome the adhesion of both pair of wheels, the Baltimore engine must be double the effective power of the English engine. The larger the cylinders, in stroke and in diameter, there being steam enough to supply them, the greater the power they afford—and the cylinders of the Baltimore engines being twelve and a half inches in diameter, and twenty-two inches stroke, while the English engines rarely exceed ten or eleven inches in diameter, by seventeen or eighteen inches stroke, the former are, of course, the most effective, since the daily experience of the Baltimore and Ohio Railroad Company shows the ample supply of steam, which the peculiar construction of the boiler affords at all times. At the end of nine months of constant use, the tubes of the Baltimore boiler have been found on examination as perfect as when they were inserted, while in the English engine the renewal of tubes is a constant source of expense and vexation. The number of tubes in the Baltimore engine is 400, while in the English engine it rarely exceeds 120, causing a proportionate difference in the fire surface, or capacity for generating steam, the heat applied in the furnace being the same.

Your Committee state these facts, which are of easy comprehension, to show that the superiority of the Baltimore engine over the English one of the same weight, is not a matter of accident only, or about which there can be any mistake, but an inevitable consequence of well known philosophical and mechanical principles.

The engines of the Baltimore and Ohio Railroad Company are manufactured by Messrs. Gillingham and Winans, at the Company's shops. Both of these gentlemen were, for many years, in the service of the Company, in the department of machinery, before they became contractors; and to them, together with the late Phineas Davis, the former contractor, is to be attributed the perfection of the present locomotive. Their establishment is a large one, employing upwards of a hundred workmen, and of itself is of great benefit through the employment that it gives, and the money which, necessarily, it is the means of circulating. The Company has a prior claim to the services of the contractors, paying a stipulative price for the engines (5000 dollars), and the machinery which are obtained from them, and paying for repairs by the time which they consume. The expenses of the shops are borne by the contractors, who build and manufacture for others as well as the Company. The shops and permanent machinery have cost the Company about 10,000 dollars,—which sum has been already returned to it in the reduced price for which the contractors build the engines, in consideration of the advantages of the use of the shops, the proximity to the road, and the opportunities of working for other companies.

In the annual report of the Baltimore and Ohio Railroad Company, the power of their engines has frequently been mentioned, and the authority and character of these reports have been quite sufficient to authenticate the facts therein stated. Your Committee are aware, however, that the incredulous as to the ascent of the plains at Parr's Spring Ridge, have not been few, and, perhaps, the very importance of the results stated, so far exceeding all previous experience, has been the cause of doubt; or, in other words, "the news was held to be too good to be true." Your Committee, however, are witnesses, with many others, to the surprising efforts

and efficiency of the engines in question, and they are glad that an opportunity has been afforded them to add their testimony in corroboration of that which reflects so much credit upon the mechanics of our country, and to express their approbation of the persevering and patriotic individuals who, in the management of the Baltimore and Ohio Railroad, have called our native talent into play, and done so much to develop and increase the efficiency of the railroad system.

All of which is respectfully submitted.

Samuel Barnes, Walter Ball, Samuel Harker, J. B. Seidenstricker, Joshua Dryden, John Scott, Henry Myers,	Committee of the First Branch.
William Reaney, Samuel Ready, James Frazier, F. Lucas, jun.	Committee of the Second Branch.

REPORT OF EXPERIMENTS MADE BY THE COMMITTEE OF THE FRANKLIN INSTITUTE OF PENNSYLVANIA ON THE EXPLOSIONS OF STEAM-BOILERS, AT THE REQUEST OF THE TREASURY DEPARTMENT OF THE UNITED STATES.

(From the *Journal of the Franklin Institute.*)

(Continued from p. 174.)

VII. *To determine by actual experiment whether any permanently elastic fluids are produced within a boiler, when the metal becomes intensely heated.*

To make this experiment, the bottom of the boiler was to be intensely heated, water to be injected, and the elastic fluids disengaged, to be collected. The bottom of the boiler being cleaned, heated water was thrown in from the forcing-pump, the elastic fluids produced flowed through a flexible tin pipe which was attached to the stop-cock *a* (plates 1 and 2), and passed into a tub containing water. At the end which dipped into the water there was a stop-cock, opening and closing the pipe at pleasure; the cock *a* was always open. On the first day's trial a small quantity of water, previously placed in the boiler, was allowed to boil away; the bottom of the boiler was heated to redness, and water injected. The stop-cock being opened under a receiver, in the tub serving as a pneumatic-cistern, a gas which issued through the flexible tube was collected, the water condensing the high steam with which the gas was mixed. The smell of this gas was empyreumatic, an opaque white vapour came over with it, which disappeared on standing. Half a pint of the gas was collected for examination. The injection of water being continued, the gas ceased to come over.

This gas was subsequently examined; it was a non-supporter of combustion, was not combustible, did not render lime-water turbid; it was, in short, nitrogen gas, with perhaps a small admixture of oxygen.

These observations were considered as only preliminary to a more extended examination of the subject. The theory which makes the decomposition of water, by heated metal, produce hydrogen, and this gas by its union with oxygen, produce explosion, has been supported by many, and deserved a respectful examination. The difficulty of finding the oxygen for the hydrogen to recombine with, has been ingeniously, though, as we conceive, not successfully, parried. The fact, that though water is decomposed by heated iron, hydrogen gas decomposes heated oxide of iron, has also been plausibly urged and supported by collateral evidence of a similar nature, drawn from the action of heated copper upon ammonia.

To study the subject in detail, it was necessary to examine the relative effects of hot and cold water; the relation between the quantity of gas produced, and of water injected, at different temperatures of the bottom of the boiler; and to raise the temperature of the metal so high that no objection on that score should exist to the results. Moreover, the oxidated surface was to be removed, and the boiler exposed to the action of the water in as clean a state as the nature of the case admitted. The gas was collected in graduated jars, the water drawn in by the forcing-pump was taken from a measure, and the quantities injected noted. The time was also noted between the experiments.

The conclusions to which the Committee were brought, render a detailed exhibition of the experiments unnecessary, except so far as such a statement may go to show the degree of care which was used in prosecuting the subject, and thus to give confidence in the results. The experiments of the first day in which the gas was collected as already described, were tentative, they served to render the methods of experimenting more precise.

On the second day one of the glass plates in the boiler-head cracked and the escape of gas with the steam, through the crack, rendered the results as to quantity inconclusive. The gas was uniformly found to extinguish a candle, and not to burn itself. The mercury in the iron tube into which the thermometer N, plate 1, dipped, soon boiled; the thermometer had been previously removed. The thermometer in the other tube M was observed as giving an indication of whether the temperature within was increasing or diminishing.

It was now distinctly seen that the air

which furnished the nitrogen gas, before referred to as issuing from the boiler, was not derived from the water injected. The injection of one fluid ounce and a quarter troy (2·25 cubic inches) of water, never gave less than 2·6 cubic inches of gas, and sometimes, notwithstanding the leakage, gave 17·28 cubic inches. But water absorbs, according to Saussure, from 5 to 5½ per cent. of its bulk of atmospheric air, giving for 2·25 cubic inches only ·118 of a cubic inch of air, not one-twentieth part of the minimum quantity of gas derived from the boiler by the injection of 2·25 cubic inches of water. On observing closely the cracked glass plate, it was seen, that after a certain period in the production of steam by the water thrown into the boiler, the vapour ceased to issue through the crack, and, finally, that a bending inwards of the pieces of glass indicated that the pressure within the boiler was less than that without, and that atmospheric air had access to the interior. As no inflammable gas had as yet been obtained, and as the gas which issued was nitrogen mixed with oxygen, the entrance of air into the boiler was obviously the source of the gas collected.

A new glass plate was substituted on the third day for the broken one, and a copper plate was screwed upon the opposite opening of the boiler, which was thus rendered as tight as the nature of the apparatus permitted. The experiments were made at regular intervals, varying in different parts of the series from 60 to 10 seconds, and in such a manner that the bottom of the boiler might be found in nearly the same state, in some of the experiments, with each interval. The interval was counted from the time at which gas ceased to issue in a previous experiment, to the instant of injecting water. The unit of measure of the gas was 1·8 cubic inches. The results were as follows:—

Fluid ounces of water injected.	Interval in seconds.	Measures of gas collected.	Ounces of water injected.	Interval in seconds.	Measures of gas collected.	Ounces of water injected.	Interval in seconds.	Measures of gas collected.
½	60	10†*	½	30	5	½	10	4
"	30	10†	"	"	9	"	60	10¾
"	"	10¾	"	"	8	"	10	6
"	"	10¾†	"	10	6	"	60	7
"	20	10	"	"	5	¾	10	5
"	"	8	"	30	10¾†	¾	10	4
"	"	6	"	10	10			
"	10	6	"	"	7			
"	"	7	"	"	5			
"	30	5	"	60	6			
"	"	9	"	"	10			
"	"	8	"	20	6			
"	10	6	"	10	4			
"	"	5	"	60	7			

In this series we remark, first, that the mean result for an interval of 60 seconds, is 8·5 measures; for an interval of 30 seconds, 9·1 measures; for 20 seconds, 7·5 measures; and for 10 seconds, 6·9 measures.

If atmospheric air leak into the boiler, the air will enter until the pressure within and without become equal. Hence an increase in the interval between two experiments in which the air should be expelled, would, above a certain point, be attended with no increase in the quantity of gas which would be expelled; the only effect being to consume, more completely, the oxygen of the entering air. Up to this point an increase of interval should be attended by an increase of air which would leak in, and consequently by an increase in the amount subsequently expelled. The mean results given above do, in fact, show an increase in the quantity of gas obtained after an interval of 20 seconds over that obtained for 10 seconds; of 30 seconds over 20 seconds. They give a slight decrease from the interval of 30 seconds to 60 seconds, which will find its explanation on a further examination of the results.

Second; we observe from the table, that after a number of short intervals, the succeeding long interval never gave as much gas as when the long interval had been repeated; and, *vice versa*, that after a series of long intervals, the next succeeding short interval gave a higher result than that which followed. The experiments, with an interval of 30 seconds, were not as much interspersed among the short intervals, in the last part of

* The numbers marked (†) signify that an unmeasured portion of the gas escaped.

the series, as were those of 60 seconds; the mean of the results for this latter interval is, therefore, diminished.

No increase in the amount of gas was obtained by increasing the quantity of water injected. The mean of four experiments, when the bottom was at a glowing red heat, and the thermometer $7\frac{3}{4}$ inches from the bottom, at from 553° to 559° Fah., was 5·75 measures for $1\frac{1}{4}$ ounces of water; from 572° to 580°, by the same thermometer, 10·5 measures for the same quantity of water injected; above the range of the scale of the same thermometer, 12 measures for $1\frac{1}{2}$ ounces, and about the same quantity for 2 ounces. During these experiments, mercury, which was on the top of the boiler, in a clay receptacle, boiled freely. The best evidence is thus given that the bottom of the boiler was not wanting in heat; it was, in fact, at a bright red heat during the last part of the experiments.

The peculiar odour, before remarked, as belonging to the gas expelled from the boiler, still continued, indicating the presence of sediment within the boiler; this could be seen when the metal was glowing. A scale of oxide also appeared on the bottom, which now and then cracked, presenting irregular luminous lines as the boundaries of the scale.

The experiments just detailed were, on a succeeding day, repeated, to ascertain whether the same results would be reproduced. The bottom of the boiler being at a bright red heat, an interval of 60 seconds gave, as the mean of four experiments, 11·5 measures of gas for one ounce of water injected; an interval of 30 seconds gave, as the mean of five experiments with three-fourths of an ounce of water, 13 measures; an interval of 20 seconds gave, as the mean of four experiments with half an ounce of water, 10·6 measures: and again, in a second series, the same interval gave 10·5 measures for the mean of four experiments with five-eighths of an ounce of water. Towards the close, the numbers for 10 seconds of interval were very variable, the mean of six experiments with ·65 ounces of water, injected when the boiler was at a cherry red, was 6·3 measures, of gas; with a heat which, to all appearance, was the same, the gas collected diminished to 3·5 measures, and averaged $3\frac{3}{8}$ measures at a bright red heat. For an interval of 5 seconds, with $1\frac{3}{4}$ ounces of water injected, $4\frac{1}{2}$ measures of gas were obtained. The conclusions to be drawn from these results agree with those already deduced from the previous experiments, which were thus confirmed. The gas collected was carefully transferred, over water, to the laboratories, where it was analysed. One specimen yielded Professor Hare, nitrogen with seven per cent. of oxygen; another, examined by Professor A. D. Bache, gave nitrogen, and $9\frac{1}{4}$ per cent. of oxygen: in each case the results were obtained by exploding a mixture of the gas with hydrogen.

The boiler was now thoroughly cleansed, that the scale of oxide upon the bottom might be removed; in doing this, the hand-hole was necessarily removed, and had to be repacked. Paper was placed between the glass plate at the back end of the boiler and its metallic covering, that the boiler might be tightened. To ascertain the amount and direction of the current setting into, or out of, the boiler at any time, a copper pipe, terminating in a glass tube, was attached to one of the stop-cocks on the head, at the fire end of the boiler, the glass tube dipping into a vessel containing water.

The injection water was, on resuming the experiments, heated over a small furnace, to boiling, in a metallic vessel, from which it was drawn by the pump. When the bottom of the boiler was at a bright red heat, the lowest thermometer had attained a temperature of 570°, and was soon after removed. The quantity of water thrown in at each stroke of the pump, was now by no means so regular as when the action of the pump was not impeded by the formation of steam within it, from the injection water. The results obtained were:—

No. of strokes of pump.	No. of measures of gas collected.	REMARKS.
2	2	Injection water hot.
"	$\frac{1}{2}$	Redness not visibly diminished by water injected.
2	3†	Bright red. Experiments made after a rest. Gas puts out candle.
2	$3\frac{3}{4}$	Bright red. Do.
2	$1\frac{1}{2}$	Do. Do.
6	3	Do. Gas burned at mouth of jar with a blue flame.
1	$\frac{3}{4}$	
1	$\frac{1}{8}$	Gas burns with blue flame.

A combustible gas had appeared for the first time. The injection water was now changed for cold water, and a gas obtained, which burned as before; 11 measures of air and one measure of the gas detonated slightly, also one to $8\frac{1}{2}$ measures of air; neither detonation was sufficiently violent to extinguish the candle held at the mouth of the jar in which the gases were fired.

The gas now came over, not in copious bubbles and during a short time, but slowly and continuously, as if resulting from a constant, but not violent, chemical action. After these results had been obtained, the violent and brief bubbling, when the water was injected, recommenced, and the combustible gas was no more obtained. The

change of hot injecting water for cold, and the collection of the combustible gas after the change, showed that the gas was not derived from any effect produced by the increased temperature of the liquid introduced. The other circumstances which had been different from those of former experiments, were the superior cleanliness of the bottom of the boiler, and the repacking of the hand hole with cloth, oil and putty, and of the glass window with paper. Before proceeding to the detail of the experiments, in examination of the source of the combustible gas obtained, it may be well to mention that the glass tube, already spoken of, showed, after the water injected in some of the experiments had evaporated, a current of air, due to a force equivalent to a head of from ½ to 1½ inches of water, from the exterior into the boiler; in one experiment it is noted that the water, in the tube referred to, soon fell, which indicated a leak in some part of the boiler.

On the day following that upon which the experiments just given were made, nothing conclusive was obtained; no combustible gas appeared, but the heat was hardly as high as on the preceding day. Small disks of wood, thrown into the boiler, gave a combustible gas, which came over just as was noticed in relation to the inflammable gas of the preceding day's experiments. That these inflammable gases, in mixture with the oxygen, remaining in the atmospheric air within the boiler, produced no explosion, is in accordance with the well-known fact in relation to them; pure hydrogen, in such a mixture, combines with oxygen under the influence of a body heated to redness.

On the following day of experiment, circumstances proved entirely favourable; the bottom of the boiler was heated as intensely as on the former occasion. After much incombustible gas had been obtained, traces of an inflammable one appeared. A strong smell of oil was noticed about the hand hole, at the back end of the boiler; the packings were now white on the exterior. The fire was urged, and the boiler became strongly heated throughout its whole length. The following results are from the journal of the experiments:—

Each stroke of the pump threw in 5-8ths of an ounce of water. The gas is that collected by one stroke of the pump.

Appearance of Boiler.	No. of measures of gas.	REMARKS.
Bottom bright red,	16	Candle burns feebly in gas.
do.	10½	A piece of paper put against back hand hole is charred.
Very bright,	14	Wood put at back end of boiler (outside) charred. Paper browns on top. Gas puts out candle.
do.	7	Gas puts out candle.
Heat same (about) as first day of finding inflammable gas,	8	
do.	8	
do.	7½	Wood chars at fire end (outside) being the less heated end.
Heat greater,	5	
do.		Gas extinguishes candle, and does not burn.
do.		No smell of oil gas. Wood at both ends charring. Paper on top of boiler charring.

No combustible gas was procured in these experiments, though the circumstances were more favourable to the production of hydrogen, by the boiler, than on other occasions. On examining the cloth packing of the hand holes at each end, it was found to have disappeared, except in spots; the putty was white. The boiler was not dirty enough to colour, with oxide of iron, clean water which was introduced.

These results point conclusively to the packing, as the *source of the combustible gas* obtained. The flame of that gas was that of carburetted hydrogen, and not of pure hydrogen. They further show that even in this intensely heated state of the bottom of the boiler no hydrogen was liberated by the decomposition of the water injected.

In conclusion, it appears from these experiments:

1. That the gas obtained by injecting water upon the bottom of a boiler which was at a bright red heat was nitrogen gas, with a variable quantity of oxygen: it was, in fact,

atmospheric air deprived, by the heated metal, of more or less of its oxygen.

2. That this air was derived, principally, from the current into the boiler when surcharged steam had ceased to be formed, and the boiler was left dry; there will, therefore, be no such quantity in a working boiler, where the air must be supplied from the cold water thrown in.

3. That water in contact with heated iron in a steam boiler, the surface being in its ordinary state, clean, but not bright, is not decomposed by the metal.

(To be continued in our next.)

RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal*, for May.)

IMPROVED DOUBLE SPEEDER, *William Field, Rhode Island.* — This improvement "consists in a plan of compressing the roving on the spool so hard, or compact, that the same quantity may be put on a spool of only one-fifth of the common size. A machine with this improvement will occupy only one-half of the room, will require much less power, and will run at least one-third faster than common speeders." The usual plans for drawing, twisting, and winding the roving, are followed; but the spools are run faster than the flyers, to take up the roving, instead of permitting them to fall back, in the common manner. The flyers are supported wholly above and independent of the spindles, are about one-half the usual length and diameter, and have a hoop at their lower ends to prevent their expanding.

The condensation of the roving is effected by the pressure of a thin circular plate against it, as it is wound on the spool; the plate being about the same diameter as the spool.

The claims are to "the plan of compressing roving on spools by circular plates, having a rotary motion, acquired by their pressure on the spools, the edges of which act on the roving as it is received from the flyers, and thereby condense it, so that a much greater quantity can be deposited on spools of the same size. The sliding rail in the rear of the spools, on which the circular plates are placed, and the connexion between the increasing size of the spools, and the traverse motion of the belt guide, so that the spools may cause the variation of speed which their constantly increasing size requires. The application of a heart motion for traversing the spools, so formed as to cause them to rise with greater velocity than they fall, so that a less quantity of roving may be deposited on the spools when rising than when falling."

DISTILLING ALCOHOL FROM APPLES, *Anson Walcott, New York.*—The pommage is to be put into a steam-tight tub, into which steam is to be admitted through a tube, which descends nearly to the bottom of it; a series of vessels, similarly connected by tubes, and perfectly resembling Woulfe's apparatus, is terminated by a condensing worm. The three last vessels, as represented, are to be hollow globes of metal, placed within open tubs, the water in which is to be sufficiently warm to keep the alcohol in the state of vapour, as, otherwise, it would condense in the hollow globes. The claim is to "the application of steam in extracting alcohol from apple pommage, without first making it into cider, and the globular metallic condensers."

SAFETY STEAM-ENGINE BOILER, *John C. F. Saloman, Reading, Pennsylvania.*—The claim under this patent is to "the principle of constructing boilers with inverted arches, so arranged as that their convex surfaces shall resist the pressure of the steam; and the surrounding of the boiler so formed by a cylindrical or polygonal casing, forming a chord to each arch the whole length of the boiler, and thus preventing the spring of the said arches; whilst at the same time the spaces between the cases and the arches thus formed may serve as fire-places and flues for generating and conducting heat."

Not only is the body of the boiler to consist of arched segments, riveted together at their edges, but the heads also are to be concave inwards, so as to be pressed on by the steam in the manner of a dome.

Such a boiler would have a much less capacity in proportion to its weight than one of the cylindrical form, and there would scarcely be a single point within it which, by yielding to the internal force, when not sufficient to rupture it, would not thereby enlarge its capacity.

The arched form, in a malleable, flexible substance, such as iron, will not operate in the same way with the stones in an arch of masonry; every indentation in the metal is a commencing point at which it may give way, and be followed by all the parts which surround it. Besides this, we see not how the places of juncture exposed to the action of the fire, and the metal forming the chord of the arches thus exposed, are to be kept from heating, and burning out. The thing at first view is specious in its appearance, but it will not stand the test of examination, or the still more searching one of fire.

APPLICATION OF HYDRAULIC POWER, *Robert Mills and H. B. Fernald, Portland.*—The rising and falling of the tide is to be employed for the purpose of condensing atmo-

spheric air, which condensed air is to be afterwards applied as a motive power, to machinery. The mode of condensing consists in placing a reservoir in the water, which shall rest on the bottom. This reservoir is to be open at bottom, to admit the water, but closed at top, to retain the air; the top is to rise to a convenient height above the line of high water; at this line there must be a horizontal partition, or diaphragm, furnished with valves, opening upwards, to admit the air as the water rises, and to retain it in the air-chamber when it falls. This chamber is to be "provided with suitable *screw-valves*, to admit of using the condensed air at pleasure;" it is to be "applied like steam." "In the falling of the water, there will be a vacuum created, or a tendency to that effect, in the air-chamber, or room; and the atmosphere being admitted through a valve, opening inward, will rush with a force proportionable to the base of the air-room, or chamber, and thus a power will be gained, in the falling of the tide, or water, which may also be employed to condense more air, or otherwise, by making the pressure of this air to work a wheel, or piston, as it enters the air-chamber."

We noticed a patent, obtained, about two months since, by one of the above-named gentlemen, for applying the rising and falling of the tide to the propelling of machinery, and showed that the plan then proposed was old, referring to a former patent for the same thing, and our remarks thereon. Although the mode there proposed is not, we think, likely to come into extensive use, there are situations where the power obtainable might be usefully applied; but if that now brought forward is intended as an improvement thereon, we are very certain that the thing will be "mended worse." To use the condensed air to advantage, would be an undertaking of great practical difficulty, and, in the present case, could not be effected, but by a very considerable loss of power; the patentees, however, have furnished us with no plan for doing this, and we will not attack windmills. We do not know even what they mean by "screw-valves;" these are certainly novelties in mechanics. There is no point more clearly ruled than that a patent cannot be sustained for a principle, but only for the carrying of a principle into effect by certain means; but, in the case before us, no means are given.*

Calendering Cloth, *Zenas Bliss Johnston, Rhode Island.*—The improvement here patented consists in the addition of a roller above the three ordinarily used in calenders, by the aid of which additional roller the cloth is twice glazed in its passage between the rollers, thereby preventing the necessity of performing the operation a second time. In the ordinary calender, it is said that the boxes in which the gudgeons of the top roller run, last generally but sixty days, the weight having to be applied on them, whilst by the new arrangement, in which a large roller with a slow motion receives the weight, the boxes will last for two years.

* See *Mech. Mag.*, vol. xvi. pp. 375 and 436.

Manufacture of Tubes and Hinges, *William Shaw, Buffalo.*—The machine intended to be described is one for bending sheet metal to form the tubular knuckles of hinges; the description is a very imperfect one, and there is not any claim made; we think, however, so far as the materials before us will justify an opinion, that the machine is sufficiently original to be claimed as a whole. The sheet metal is to be passed in between two blocks of steel, and held in its place by a tightening screw; when, by turning a crank, the end of it is bent round a pin, which pin is to be pushed out by placing the hand upon a lever, thus forcing up a round punch, or wire, for that purpose.

Artificial Stone, &c., *Charles Clinton, New York.*—Limestone is to be burnt until about two-fifths of it is converted into lime; to four bushels of this, when cool, four pounds of pearl-ash and three pounds of alum are to be added, and the whole ground fine; the composition is to be put into open barrels, and to remain there until the lime is perfectly slacked, after which it is to be mixed with water to a proper consistence, and used as a hard finish for walls; when rubbed down, it is to look like polished marble. For outside walls, about one-third part of sand is to be added. The composition may be variegated in its colours by the addition of proper materials for that purpose, and a variety of modes are suggested for varying the ornamental appearance of it. "Blocks, pillars, &c., may be formed of the cement, and, when sufficiently dry, may be plastered, as before directed, and polished."

MR. HANCOCK'S STEAM-CARRIAGES.

Statement of One Month's Performances on the Paddington-road, from May 16 to June 15.

42 trips from the City to Paddington.
116 ———————— Islington.
Number of passengers carried ..2970.

On the occasion of the opening of Moorgate-street by the Lord Mayor, on Monday last, the "Enterprise" entered immediately after the train of Aldermen, when one of the City officers mounted the roof, waving a large flag. The steamer was full of passengers, and loudly cheered by the populace.

NOTES AND NOTICES.

Velocity of Water-Wheels in the Night.—Popular notions must always be a subject of curiosity and interest to philosophical inquirers, whether these notions are founded on observation, or confounded with superstition; and we are not aware that any popular notion is more extensively diffused among millers (though many of them may not believe in it), than that which ascribes a greater velocity in the night than in the day to a water-wheel under the same head. Why there should be any difference, none of the believers in this doctrine have even been able satisfactorily to explain. To argue against it has been futile, because early prejudice was stronger than the powers of reason; and, therefore, no other way remained that could prove effectual, but to bring it to the test of experiment. For this labour we are indebted to Professor Cleaveland. His statement, which follows, is contained in a letter to Professor Silliman, and published in the *American Journal of Science and the Arts*:—"In a former letter I mentioned the opinion existing in this part of the country, that saw-mills move faster during the night than the day. The explanation usually given by the workmen is, that the air becomes heavier after sunset. I selected a fine day in August, and requested that all the mill-gates might remain stationary for twelve hours. At two o'clock p. m. I suspended a barometer in the mill; the pressure of the atmosphere was equal to 30·19 inches; the temperature of the water just before it passed the mill-gate was 72° Fahr. The log was then detached from the saw, and the number of revolutions of the wheel, being repeatedly counted by different persons, was 96 in a minute. At midnight I again visited the same mill. The barometer stood at 30·26 inches, the pressure of the atmosphere having increased seven hundredths of an inch. The temperature of the water was 72°, the same as at the preceding observation, although it had been a little higher during the afternoon. The log being detached as before, the wheel was found to revolve precisely 96 times in a minute, showing the same velocity as at the preceding noon. The depth of the water was the same during both experiments. The workmen were satisfied that the result of the experiment was correct, but still they seemed to believe that it would be different in a cloudy night."—*American Railroad Journal.*

To Purify Cold Short Iron, a very simple process is practised in some bloomeries, which consists in throwing on the loupe at the moment when it is formed, half a shovel full of powdered flux, and keeping it afterwards exposed to the air of the bellows for a few moments, before it is carried to the hammer. The flux thus employed is a limestone, which yields lime of good quality. Its effects on the loupe are very prompt, depriving the iron of the siderite or phosphate of iron, which, as is well known, renders the iron brittle when cold. —*Ib.*

Method of Bronzing Iron and Gun-Barrels.—Gun-barrels when damasked are less liable to rust, and any of them, of whatever price, may be treated by a very simple method, which will diminish their readiness to oxydise. When the iron is well scraped and cleaned, cover its surface with a coating of butter of antimony. If one is not sufficient, two or three coatings may be given. The iron thus acquires a berny reddish brown colour, which is not unhandsome, and which preserves it from rust. When the iron has acquired the desired tint, wipe it carefully, warm it a little and then rub it with white wax, until there remains no longer any visible traces of the wax. This renders its preservation complete.—*Ib.*

A good Safe, or victual-preserver, is prepared by making it of a double case of wire-gauze, and filling the interval with fresh charcoal, in fine pieces. Fresh meat, when suspended by hooks from the top, will keep good and sweet for a week in this safe, in the hottest weather.—*Ib.*

Method of Coating Busts and Plaster Casts, so as to give them the Appearance of Marble; by M. Pleuvarre.—Into a wooden tub or trough, put a strong and warm solution of alum. Into this plunge the bust or plaster cast, previously made perfectly dry, and let it remain therein from fifteen to thirty minutes; then suspend it over the solution, that the superfluous portions may drain off, and when it is cold, pour over it a fresh portion of the solution, and apply it evenly by a sponge or cloth. Continue this operation until the alum has formed a crystallised coating over the whole surface. Put it aside, and when perfectly dry, polish it with fine sand-paper, or glass-paper, and complete the polish with a cloth slightly moistened with pure water. A wooden vessel is best for the solution, warmed by steam from a boiler, because metals are apt to colour the solution. This coating gives greater solidity to the substance, and possesses the whiteness and transparency of the finest marble. It stands the attacks of moisture in any apartment —is less subject to become soiled, and is as easily cleaned as marble. In this manner, excellent copies may be obtained of antiques, as well as moderns, at a price little exceeding common plaster casts.—*American Journal of Science and Arts.*

New Iron Steam-Boat.—The wrought-iron steam-boat, ordered from England by the Steam-Boat Company of Georgia, arrived (in pieces) at Savannah, last week, on board the British ship Alcyone, Captain Muir, from Liverpool. Her length is 120 feet, her beam 26 feet, and her depth 7½ feet. It is estimated by her builders that she will draw, with all her machinery and every thing on board, 2 feet 3 inches. She will have an engine of 46 English horse-power, on the low-pressure principle.—*American Railroad Journal, April 23.*

Communications received from X. Z.—A Subscriber—Mr. Henderson—Mr. Pearson—Mr. Curtis —Mr. Smerdon—Mr. Baddeley—F. H.—Colonel Maceroni—Mr. Croft.

Errata.—In No. 670, p. 133, col. 2, line 23 from bottom, for "common river" read "common sewer."—P. 134, col. 1, line 32 from top, for "the church" read "the whole."

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C. E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

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POTTS' PUMP FOR FEEDING STEAM-BOILERS.

Fig. 2.

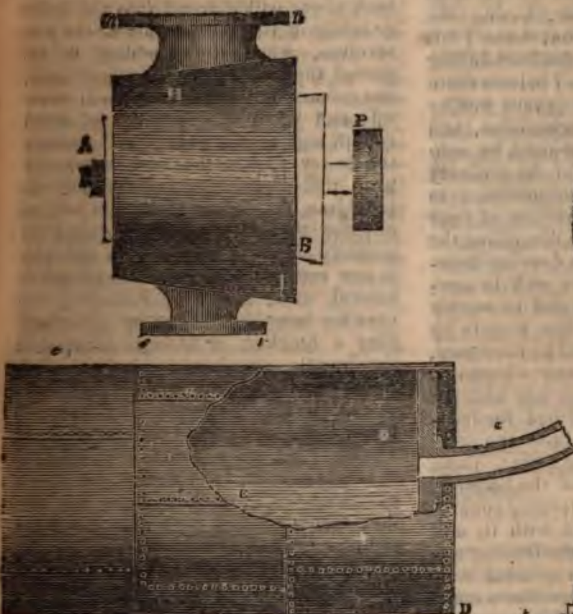
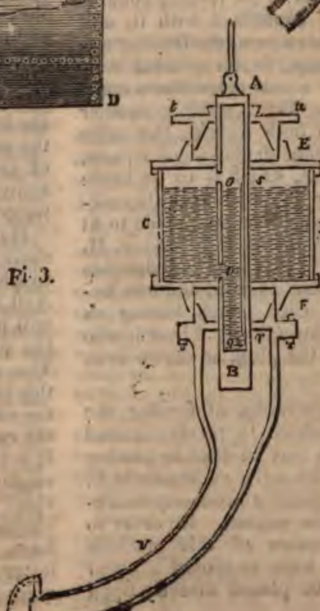


Fig. 1.

Fi 3.



PLAN FOR A NEW PUMP FOR FEEDING STEAM-ENGINE BOILERS, &C. BY CHARLES POTTS, CIVIL ENGINEER.

(From the *Journal of the Franklin Institute.*)

Having had occasion, some years ago, to construct a small steam-engine, with a view to make a few experiments in dynamics, and being desirous to make all the parts of my engine in the most simple and easy manner, having the least quantity of work about them, I fell upon the following plans for introducing water into the boiler. As I believe there is something in this contrivance worthy the attention of the mechanician, and that it may, in many instances, be substituted with advantage for the ordinary pump, I am desirous of submitting it to the public, through the medium of your scientific journal. Before describing the plans, as exhibited in the drawing herewith presented, it may be well to premise, that the water intended to supply the boiler is caused to flow therein by gravitation. Hence, it will be necessary, in all cases, that the water wherewith the boiler is to be fed, together with the apparatus herewith described for feeding, should be elevated above the level of the top water line of the boiler. Thus, in fig. 1, C, D, represents the boiler of a steam-engine, with the feeding apparatus, or pump, connected with it, and above it. In this figure, the feeding apparatus, or pump, in its general construction, very much resembles a common plug-cock. Fig. 2, exhibits another view of it; in both figures, the same letters of reference denote similar parts. A, B, is the plug, which is to be made *hollow*, as in fig. 1, and to have its exterior surface turned true, and made to fit steam-tight into the shell, or casing, H, I. This casing is cast with two flanches upon it, one above, as *m*, *n*, and one below, as *s*, *t*; each flanch having an opening, *o*, *o*, through it. There is also an opening in the plug, as shown at *w*, fig. 3.

During the operation of feeding, the plug, A, B, is caused to revolve around in its seat; this may be done by placing a pulley upon its axis, as shown at P, fig. 2, and strapping it from any convenient part of the engine. In order to show the operation of this machine more clearly, I have supposed a water tank, K, L, to be placed directly upon the upper flanch, with a pipe and ball cock from the *water pipes in the streets*, to supply it with cold water. The operation of this pump will be as follows: When the engine is put in motion, and, consequently, the plug, A, B, the opening, *w*, in the plug, will be brought round to the position shown in fig. 1; in this position, the cold water from the tank above will *descend into the hollow or cavity* in the plug; but as the plug revolves, when the opening, *w*, has passed the opening in the upper flanch, the connexion with the tank will be cut off; and when the opening, *w*, moves round, and comes over the opening in the lower flanch, the water from the plug will descend, and pass down the tube into the boiler, C, D. It will be obvious to the mechanician, that the quantity of water passed into the plug in one revolution, may be regulated in several ways, either by enlarging the opening into the plug, or by giving the plug a quicker, or slower, motion, at the time the openings are in juxtaposition.

To equalize the pressure above and below the water in the hollow of A, B, a small pipe, or channel, *x*, *y*, is made to the casing, H, I, whereby the steam passes up to the opening, *y*, in the casing; and when the opening, *w*, of the plug, is over the lower opening to the boiler, the small hole, *z*, will be in connexion with the opening, *y*, so that the stream is then admitted into the top of the hollow of the plug, and the water in the plug will descend freely by the force of gravity. A similar opening may be contrived for the free admission of the water from the tank into the plug.

Having now described this pump, I shall make a few remarks in reference to what I conceive to be its advantages. And first: we have an apparatus which will perform all the functions of a forcing pump, without valves. Secondly, The only resistance in the working of this pump, will arise from the friction of the exterior surface of the plug against the casing, as it revolves. And, thirdly, It is a sure and certain regulator for the supply of water to the boiler. The first two items above mentioned are so obvious, that it were needless, perhaps, to comment upon them; the latter item, however, may not be quite so apparent. I will there-

fore show how the pump may serve as a *regulator*. The feed-pipe, *u*, *v*, must be connected with the boiler at the top water line, as E, E. Now, if the pump supplies water faster than it is evaporated, and the top water line, E, E, rises so as to cover the opening of the pipe, the pipe would be filled with water instead of steam, and, consequently, the water in the plug, A, B, could not descend. When, however, the top water line, E, E, of the boiler, descended below the opening of the pipe, *w*, *v*, the pump would again operate to supply the boiler. In this manner, it would work so that, if properly adjusted in the first instance, the water in the boiler would always be continued at its proper height. It will be seen that, every time the pump, or plug, A, B, discharges its contents into the boiler, the chamber of the plug becomes filled with steam, and will be allowed to pass off and condense, when the opening of the plug connects with the tank. This process, it must be evident, will be an advantage, rather than otherwise, as much of the caloric of the steam will thus be imparted to the water, previous to its passing into the boiler. I have preferred describing the above apparatus, as it is the most simple in its construction, and, therefore, more easily to be understood. The same end, however, may be effected by a very different arrangement, as will be seen by reference to fig. 3. Here, A, B, represents a *hollow plunger*, being turned smooth and true on its exterior surface, and made to work up and down through two stuffing boxes, E and F, placed on the ends of the hollow cylinder, or box, C, D. The plunger has three openings, *o*, *p*, *q*, (or it may be one long slot from *o* to *q*.) for the purpose of allowing the water to flow into and out of the chamber, C, D, through the hollow plunger; the small tube, or channel, *r*, *s*, is to allow the steam to enter at the top of the chamber, C, D, in order that the water may flow freely out from the chamber into the feed-pipe, *v*. If we suppose the water tank, K, L, fig. 1, to be placed on the flanch, *t*, *u*, fig. 1, and the plunger, A, B, to be connected with the engine, so as to be caused to move up and down, as the plunger of the ordinary forcing pump, it will be perceived that, when the plunger is up, the hole, *o*, will be within the tank, and the hole, *q*, within the chamber, C, D; hence, water from the tank may flow in and fill the chamber, C, D; and when the plunger is down, as is represented in the figure, the hole, *q*, will be open to the boiler, and the water in the chamber will dedescend, through *p* and *q*, into it. The relative diameters of the plunger, and that of the chamber, C, D, may be varied to suit the motion which is given to the plunger.

Philadelphia, February, 1836.

P. S.—I am aware that, in the practical operation of the above described pumps, some difficulties will probably occur, but I am fully pursuaded that they are not insurmountable. Thus, for instance, when the pump is designed to regulate the quantity of water to the boiler, as it would be necessary to have the connexion of the feed-pipe with the boiler near the top water line, the water from the boiler would frequently rise in the tube, and run up to the pump before the body of water in the boiler had risen to cover the opening of the feed-pipe. This difficulty would be remedied by a small tube from the top of the boiler, fig. 1, to the opening, *y*, in the casing of the pump.

REASONS AGAINST THE DUKE OF WELLINGTON'S INTERFERENCE WITH THE RAILWAY SYSTEM.

[We extract the following very judicious observations on this head, from a letter to the Duke of Wellington, which appeared in the *Courier* of Tuesday, June 7th.]

It is the peculiar characteristic of this country that great public works can be executed by private capital and enterprise without assistance from the public purse; and to the encouragement which this spirit has received under a free and constitutional Government, may be attributed the vast benefits which the nation has derived from its canals, its docks, and other public improvements.

Wealthy individuals have been found ready to advance their capital for such works, because they could rely on the good faith of the Government and the country at large in securing the possession of their property.

It is, therefore, the duty of Parliament to take care that in their endeavours to protect the people from the consequence of a possible monopoly in these works, they do not run into the contrary extreme, and, by ill advised

restrictions, *put a stop to them entirely*. It is my opinion, that, in a national point of view, this latter consequence is far more to be apprehended than any other danger of monopoly.

A capitalist embarking money in these works is well aware that he incurs a certain risk. It is only from the hope of a possible large profit that he will engage in them. If you cut off this hope you extinguish the spirit of private enterprise, and with it the means of national advancement.

But it is said that the public have a right to some participation in the profits of these works, and that when an ample remuneration has been obtained by the proprietors, the people at large should then be admitted. I entirely agree in this constructive right of partnership, provided it be arranged like other partnerships on equitable principles. But the public must, on the common principles of justice, take a partnership in the whole—they cannot claim to share the benefits of those undertakings which may prove to be prosperous, without first deducting the loss arising from others which may have failed.

I will give your Grace an instance to show how this principle would work.

Two of my friends and myself were original shareholders in the Southwark and Waterloo Bridges. You will admit that both these works are of great general utility, the public derive daily and permanent benefit from them, but we are losers of upwards of 12,000*l*.

We now hold shares in railways from whence there is every prospect of gradually retrieving that which we have lost on the bridges.

If we do so retrieve our capital, the public will still be the gainers by the subsistence of the works, but I totally deny their claim to be admitted as our partners until we have so retrieved it.

This case your Grace will find on inquiry, to be by no means a singular one. There are hundreds in the same position; and it is a fact capable of the strictest proof, that if the sum total of capital expended by private individuals in works of admitted public utility is taken in the aggregate, and the sum total of the income derived from those works is set against it, it will be found that they do not on an average return an interest of three per cent.

So long as this state of the account remains, the public can have no right to complain, nor can they claim to be admitted until the balance is shown to be largely in favour of the proprietors.

But I would wish the subject to be considered in another and still more important view.

It is apparent, from the extent to which these works are projected, that there is a large unemployed capital in the country. This capital is chiefly in the hands of persons who have earned it in commerce, and is a test of the general prosperity of the country. But the persons so possessed *will* dispose of it to the utmost advantage, and if the means of doing so are not given in our own country, they will seek them in others.

This is no matter of speculative opinion, it is an actual fact; and there are foreigners at this moment in London attempting to raise English capital for the execution of works of this description on the Continent. They cannot effect this to any extent, so long as there are channels open at home; but once impose restrictions, such as to shake public confidence here, and you will see the consequences. English capital, to an enormous amount, will be sent abroad, where they are anxious to obtain it, and will not impose restrictions. Gold must necessarily be exported, and a panic like that of 1825 will ensue. I am no alarmist, nor do I wish to overstate these consequences, but I firmly believe the apprehension to be well founded, and as all experience has shown it to be, so I should act on it myself.

I think these facts will tend to convince your Grace, that the measure you have proposed is not one affecting merely a few speculative individuals, but that it is really a great and important public question, and that if entered on by Parliament, it should be considered as such, and be discussed gravely and with sufficient notice. It is not a matter which ought or can be properly considered on the debate of one or two particular measures, and I insist the more earnestly on this, because I must say that, with every respect for your Grace, the proposition was made in a manner and at a time which showed that you did not appreciate its extent or importance.

It appears that the House of Lords did, early in the session, consider and determine on the course they should pursue with reference to the railway bills, and certain resolutions were promulgated, on which the parties have hitherto proceeded. It seems, moreover, that several of such bills have actually passed, and have received the royal assent according to the established practice, and but for the (perhaps accidental) circumstance of your Grace's presence on Friday last, that bill on which the question arose would have passed also.

Now I do say that this species of hap-hazard legislation is not that which the subject deserves, or which the country is entitled to expect. There is scarcely a family of respectability in the country which has not some member of it more or less interested in these works, and if a great change is to be made, the people are entitled to expect that it should be made deliberately and after full

discussion of its merits—that the whole bearing of the question should be considered, and that all parties should have an opportunity of being heard.

* * * *

Whatever may be the regulation ultimately adopted, I venture to submit that Parliament cannot at present go farther than to resolve that the tolls granted by the railway acts shall be considered as subject to such periodical revision as Parliament shall hereafter, *by a general act* for that purpose, declare.

This would give time for inquiry and discussion and the frame of the enactment, and, above all, the period to be limited on which so much must depend would be duly considered.

I do not here enter on the subject of the general expediency of the proposed restriction, but I think I may say that it has not arisen out of any expression of public opinion of its necessity; and that if the question were asked of the public at large, whether they would prefer the risk of establishing a monopoly, or of throwing a damp on the spirit of improvement, they would, by a large majority, decide on the former. The public know that no monopoly can long exist in England, but they cannot foresee the effects of restricting the free course of enterprise, and paralyzing individual industry.

CIRCULATING DECIMALS.

Sir,—It is a singular omission in most works on arithmetic, in Hutton's mathematics, and several others, that no mention is made of continued fractions, although their application to questions relating to decimals and their equivalent vulgar fractions is most important, a few instances of which I adduced in a communication you inserted from me in vol. xi. p. 227, which comprises some practical rules and examples on this interesting subject.

The second rule given, by G. C. L. (p. 68 present volume), for finding by continued fractions the equivalent to any given decimal, is, as an *approximating rule*, more generally useful than the one I give. I have for some time used a similar method for finding two consecutive indices in any given decimal series; as the difference between any two consecutive indices, and the complementary indices must be the same; a means is afforded for determining the denominator of the series.

It was, I think, wise on the part of "A Country *Teacher*" *not to sign his* name to the communication inserted in No. 670, p. 175, as he must, on reflection, feel ashamed at the supercilious tone in which he has clothed his remarks. His must be an intellect of no common order, when he can take in his mind's eye what he considers neither myself nor G. C. L. can discover by calculation.

A very short time enabled me to find out two fractions, which, if not identical, very closely resemble those referred to. The one is $\frac{8302}{19503} = \cdot425678119 +$, and the other, $\frac{1177}{2765} = \cdot425678100 +$. The first is a pure circulate, and the other a mixed one. This I infer from some fanciful properties which I have observed, and I do not suppose "A Country Teacher" can do more, for I dare say he has never calculated the whole of either series, or would be willing to do so; nor do I think he could discover any of the latter figures of the series without first producing all that preceded them; either of which I can readily do by some of those fanciful properties he affects to despise.

His opinion respecting the neglect of your mathematical friends to notice my question is of little importance; it cannot but be acknowledged, that what is published on the subject in our books of arithmetic, and even in the Encyclopedias, is very imperfect. Most of them direct to perform the operations of addition and subtraction to make the decimals similar and conterminous. Now this is practically impossible, except in a very few cases. Some authors, seemingly aware of this difficulty, direct that these decimals should be converted into their equivalent vulgar fractions; and in the case of a mixed circulate, tell the learner to subtract the terminate part from the *last figures of the series*, and to place a certain number of nines and cyphers equal to the number of figures in the series as a denominator, and then to reduce this fraction to its lowest term. The practical absurdity of this rule must be apparent to any one who reflects upon the immense number of figures in many of these series. A really practical rule I never saw published till my communication and that of G. C. L. appeared in your pages.

I must be considered to have a very

limited knowledge of the nature of fractions, did I not know that there is an infinite number of *exactly* the same value, and that it is most advantageous to exhibit them in their lowest terms. The doctrine of continued fractions has also long taught me that there is an infinity of fractions *nearly* equal to any given one, and that in any ratio it was certainly an oversight of mine not to remark, that in the practical application of my rule it is requisite that a certain number of figures of the series should be given according to the magnitude of the denominator; but, in truth, I did not consider my communication to be addressed to school-boys.

The most important charge against me appears to be my doubts of the existence of decimals "that go on to infinity, *following no regular law*." I can assure your correspondent I have no doubts on the subject; I positively deny their existence. If any such exist, they must have an infinite number for their denominator, else the variety of remainders, from which the successive terms of the series is produced, cannot be infinite; for if the denominator be not infinite, the series must recur or else be finite.

Although neither myself nor "A Country Teacher" may know the law that regulates a decimal series equivalent to the square root of an incommensurable number, it would be an absurdity, and contrary to all our experience, to suppose that it follows no regular law. I am willing to pay due respect to the opinions of the learned, but must be allowed to hold opinions of my own. The time is passing away when the *dictum* of any man or set of men shall constitute a test for truth.

I shall feel obliged if "A Country Teacher," or any other of your correspondents, will explain the reason of the following:—If 7 be set down on the right hand and multiplication be made with 5, setting down the units of the products on the left of the 7 to form a multiplicand, the result will be the equivalent of one-seventh. Setting down 3, and multiplying by 4, will, in a similar manner, form the reciprocal of one-thirteenth.

Yours respectfully,

ANTHONY PEACOCK.

PRACTICAL SUGGESTIONS ON THE WORKING OF INCLINED RAILWAY PLANES AND CANAL LOCKS.

Sir,—The following plans are communicated for insertion in the *Mechanics' Magazine*, should you deem them deserving a place.

The first plan is designed to facilitate the transport of waggon-trains on railroads over ascents of considerable acclivity.

I assume the propelling or tractive power of a rotary-engine to be in the inverse proportion of the diameter of its wheels. This is obvious from the consideration that a double stroke of the piston produces one revolution of the propelling wheels, and causes the engine to move over a space equal to the circumference of its wheels. For the application of this principle I propose to have attached to the wheels of the engine a second series of felloes and tires, say of half the diameter, and interior to same. To receive these there must be constructed a corresponding elevated rail on such sections of the road, as, from their acclivity, require a considerably increased tractive power. This, on the assumption of the above, I presume, incontrovertible principle, must double the tractive power of the engine while it moves on the interior reduced wheels.

My next project is designed to raise or lower canal-boats from one level to another *without any loss of water*. The importance of obtaining this result will be sufficiently apparent to any one who will take the trouble of referring to a paper on this subject in your Magazine for April, 1833, p. 31.

I propose to have a case or chamber constructed of sheet iron, or other material impervious to air, of the same capacity and form as the lock or basin to which it applies. That it be so adjusted as to be capable of being lowered into the lock at pleasure, and to be kept in position by grooves cut in the sides of the lock, with corresponding projections on the case or chamber, which prevent disturbance in sliding up and down. To the upper surface of this moveable chamber the apparatus of the air-pump is to be attached, on a scale proportioned to the capacity of the chamber.

To effect an *ascent* of the boat from the lower to the upper level. On the ad-

vance of the boat within the lock, the chamber is to be lowered and exhausted of air till the water thereunder (which is of the lower level) rises somewhat above that of the upper level. Then air must be admitted into the chamber to effect, or rather permit, its withdrawal, when the flood gates of the upper level may be opened and the boat withdrawn.

For effecting a *descent* from the upper to the lower level of the canal. The lock being filled with water as above, the process adopted in ordinary locks for lowering the water must be followed.

I am, Sir,

Your obedient servant,

ROBERT CAREY,

Rector of Donoughmore.

Clonmel, Ireland, June 20, 1836.

THE STEAM-CARRIAGES' BILL.

A Bill is now in an advanced stage before the House of Commons, to which, if we were to judge of it from its title, we should feel bound to wish all possible success. It is intituled "A Bill to repeal such portions of all Acts as impose prohibitory Tolls on Steam-carriages, and to substitute other Tolls on an equitable footing with Horse-carriages." But on looking into the Bill itself, we find clauses there which have nothing whatever to do with tolls—which no one could have reasonably expected to find there—and which are of a most debateable, or rather, we should say, of a most decidedly partial and unfair description. We refer particularly to the clause "*prescribing* the dimensions of vessels for generating steam"!!!

If there were nothing improper in the provisions contained in these clauses, why attempt to smuggle them in this manner through Parliament? Is smuggling usually taken as a proof of honesty of purpose? Why not have stated in the title of the Bill that it was meant to regulate the manner of constructing steam-carriages as well as the tolls they should pay? What good reason can possibly be given for so important an omission? Was it feared that if the title had been so framed, the numerous individuals who have embarked in the projection of steam-carriages for common roads might have taken alarm at the measure that was in progress, and have insisted on seeing that they were not unduly damaged *by it?* And if such fear was entertained—as no doubt it must—was it right to deal thus in secret with the interests of others? Either just towards those who were to be individually affected by the Bill, or fair towards Parliament which was to be made the unconscious instrument of (possibly) much individual injury and annoyance? And if, per adventure, the authors and promoters of this Bill should be some knot of persons concerned in forwarding one particular steam-carriage speculation to the prejudice of all others, and that a speculation which would be favoured by the restrictions stealthily introduced into the Bill, while every other would be damnified by them—can the whole affair be considered as any thing else than a rank job?

Matters are not mended by the fact, that the *preamble* to the Bill is just as silent as the *title*, with respect to the more material (because most onerous) portion of its contents. Every preamble *should* give the sufficient reason for the enactments which follow; but this gives no reason whatever for the clause introduced respecting the construction of steam-carriage boilers.

Now as to the particular clause in question:—it is thereby enacted "that it shall not be lawful to use any vessel or vessels for raising or generating steam, to propel any carriage along a public street or road, any part of the transverse section of which shall exceed ten inches in diameter in any direction, if circular or cylindrical; and if such vessel or vessels shall be made of any other figure than cylindrical, then no part of the transverse section or sides shall exceed eight inches in any direction, under a penalty for every breach of such regulation, not exceeding one hundred pounds, or less than twenty pounds."

We shall not stop to discuss the policy of the State's interfering with the march of science by such restrictions as these, but content ourselves for the present with asking how it has been ascertained that ten inches diameter is the limit of safety in the case of circular or cylindrical vessels, and eight inches in the case of vessels of other figures?—when and where the experiments were made by which these points were supposed to have been established? and *by whom* (this especially) they have been proved to the satisfaction of the Committee which sat upon the Bill? Some

little information on these points the scientific world is surely entitled to look for, before any such restrictions are imposed; nor would it be deviating much from ordinary usage were some little time given for considering and weighing the force of the evidence (whatever it may be) which has been given on the subject.

What if it should turn out that the restrictions proposed are calculated to protect one particular boiler to the exclusion and proscription of all other boilers? And what if the inventor of that particular boiler, and the friends of that inventor, should appear to be the authors and promoters of the Bill by which they are to be so exclusively and unfairly benefitted—pretending the while to be actuated solely by a regard for the interests of the public? Suppose, for instance, the effect of these restrictions would be to drive Mr. Hancock's carriages off the road—the said Mr. Hancock being the only person who has now vehicles of this description running for the public convenience, and having done more than all the other steam-carriage projectors put together to bring to maturity the application of steam-power to common-road travelling—and to give a monopoly of the speculation to some competing, but less successful and meritorious inventor—a Gurney, a Dance, or a Macneil;—suppose such to be the case (a supposition, we suspect, not very wide of the reality)—and who (but the favoured parties themselves) would not feel anxious to see the Legislature spared the disgrace of such a monstrous act of injustice and oppression?

The Bill professes to apply only to steam-carriages on common roads, but the boiler-dimension-prescribing clause, as it is now worded, is equally applicable to railway steam-carriages; though this, we presume, can hardly have been intended. The words are:—"Any vessel or vessel for raising or generating steam to propel any carriage *along a public street or road*." A railway is, of course, as much a public road as any other entitled to that denomination.

Another peculiarity there is in the clause not unworthy of observation. It merely prescribes the dimensions of the vessels employed for *raising* or *generating* steam, and says nothing about any vessels in which it may be received and stored up for use. Is it imagined that danger only attaches to the former? Or is there such a thing as a *separation* in the case (Mr. Gurney's, for instance,) which it is desired to exempt from the operation of the law?

The Bill is in too advanced a stage in the House of Commons (having been committed and reported upon, and standing for a third reading this evening, Friday, to allow us to hope that it can now be thrown out, or reconsidered there; but we trust that when it reaches the Upper House, means will be taken by those whom it immediately concerns to have its merits fairly canvassed. We have done our duty in drawing public attention to it, and should have done so sooner, but that owing to the deceptiveness of its title, we had no suspicion of its mischievous tendency, and only a day or two ago stumbled by accident on a copy of the Bill.

HISTORICAL NOTE ON THE DISCOVERY OF THE NON-CONDUCTING POWER OF ICE. BY A. D. BACHE, PROF. OF NAT. PHILOS. AND CHEM., UNIV. PENN.—

(From the *Franklin Journal*.)

In the fourth series of his electrical researches, Mr. Faraday devotes himself to the establishment of a "new law of electric conduction." In the course of experiments for this purpose, he says that he "was suddenly stopped by finding that ice was a non-conductor of electricity, and that, as soon as a thin film of it was interposed in the circuit of a very powerful [voltaic] battery, the transmission of electricity was prevented." This observation is made to lead to a beautiful train of research on the conducting powers of various oxides, salts, chlorides, &c., capable of existing in both the solid and liquid states. In these experiments, a galvanic battery of two troughs, containing twenty pairs of four-inch plates, was used.

Similar results were obtained with electricity from the machine. A thickness of five-sixteenths of an inch of ice scarcely allowed the electricity to pass at all, though of this high tension.

It seems, then, that Mr. Faraday thought it necessary to investigate this fact, which he had accidentally observed in relation to galvanic electricity, in its application to electricity as evolved from the machine.

That ice is a non-conductor of electricity, thus evolved, was, however, well known to Dr. Franklin, and his associates; and whatever merit attaches to this discovery, which was considered a curious one, belongs to him, or to them.

In one of a series of letters to Mr. Peter Collinson, of London, dated in 1747 and 1748, in which he gives an account of experiments made by himself, Kinnersley, Hopkinson, and others, Dr. Franklin has the following remark: "A dry cake of ice, or an icicle held between two in a circle, likewise prevents the shock, which we would not expect, as water conducts it so perfectly well."

Again, in the paper on the aurora borealis, read before the Royal Academy of Sciences of Paris, in April, 1779, and entitled, "Suppositions and Conjectures towards forming an Hypothesis for the Explanation of the Aurora Borealis," the basis of his theory is this same want of conducting power. He says, "Water, though naturally a good conductor, will not conduct well when frozen into ice by a common degree of cold—not at all when the cold is extreme."

"The great cake of ice that eternally covers those [the polar] regions, may be too hard frozen to permit the electricity" "to enter the earth." "It may, therefore, be accumulated upon that ice."

Dr. Watson had previously affirmed ice to be a conductor; and, subsequently, Bergman and others were of the same opinion, doubtless for their not attending to the "dryness" of the ice. Bergman found reason to change his opinion, and Archard, Erman, and others, have confirmed the accuracy of Franklin's statement. These authorities have caused ice, at a low temperature, to be ranked among electrics, in the elementary works devoted to this subject.

As far as the passage from the solid to the liquid state is concerned, our electricians seemed to have been better informed than the following sentence from paper of the Prof. Faraday, before referred to, supposes,

"This assumption (he says) of conducting power by bodies as soon as they pass from the solid to the liquid state, offers a new and extraordinary character, the existence of which, as far as I know, has not before been suspected."*

It is true that this remark applies particularly to galvanic electricity, but as Mr. Faraday repeated many of his results with the machine, to prove them to be coincident with the others, he obviously does not intend to limit his remarks. "All these effects," he says, "produced by using the common machine, and the voltaic battery, agree, therefore, with each other."† Again, "the conducting power of these bodies, when fluid is very great."‡

In a letter to Cadwallader Colden, of New York, dated Philadelphia, April 23d, 1752, Dr. Franklin says, "I do not remember any experiment by which it appeared that highly rectified spirit will not conduct; perhaps you have made such. This I know, that wax, rosin, brimstone, and even glass, commonly reputed electrics *per se*, will, when in a fluid state, conduct pretty well. Glass will do it when only red hot."

He again states the same fact in the paper on the aurora, before referred to, thus:—"A certain quantity of heat will make some bodies good conductors, that will not otherwise conduct.

"Thus, wax rendered fluid, and glass softened by heat, will both of them conduct.

"And water, though naturally a good conductor, will not conduct well when frozen into ice."

In these effects, our electricians saw only the general effect of heat on the conducting power of bodies, while Mr. Faraday ranks the effects observed by him in quite a different class, and founds upon them the general law that decomposition is necessary to conduction.

Philadelphia, January, 1836.

EFFECT OF DRAWING, ROLLING, ANNEALING, &c. OF THE METALS.

In a paper on the ductility and malleability of certain metals, and on the variations of density which they undergo by different operations, M. Baudrimont developes the following interesting facts.

At a temperature rather above a cherry red, iron wire remained three months, surrounded by charcoal, without cementation taking place. A white heat, in

* Prof. Faraday's Experimental Researches in Electricity. Fourth series. Art. 412, Royal Soc. Trans., 1833.

† Ibid., art. 431.

‡ Ibid., art. 430.

five minutes, gave the properties of cast-iron to a square bar of malleable iron, of four-tenths of an inch on a side.

Wires of copper, and of alloys of copper and zinc, are increased in diameter, and diminished in density, by annealing. The operation of rolling condenses the metals more than that of wire-drawing. The density of iron and copper is greater, if the metals are heated before being passed through the rollers. The reverse is the case with alloys of copper and zinc. The density of the metals is greatest when drawn into very fine wires.

Wires may be increased in length in two ways, by a diminution in the area of their cross section, or by increasing the distances between their particles. When wires are lengthened in the manner last named, they return to their former length by annealing.

Hydrogen has an action on copper and silver, at high temperatures, which permanently separates their particles. On alloys of copper and zinc, and even of silver and copper, it has no such action.

Wires of different metals, which, after passing through the same hole in the wire-drawing plate, have different diameters, acquire equal diameters by annealing.

The diameter of a wire increases, very slowly, by time, after passing through the wire drawing plate. Wires which have been bent, and then straightened, re-acquire a curvature.

Wires exposed to a high heat, lose a part of their tenacity. They require to be annealed in wire-drawing, not to render them more tenacious, but to allow the particles to resume the positions from which they may again be displaced. The loss of tenacity is common to copper, iron, platinum, and the alloys of copper and zinc.

Brass wire approaches to iron in strength, while copper is inferior to it. Brass may be used instead of iron, where the latter would oxidate too rapidly.

The iron wires are given at strengths from 79,000lbs. to the square inch to 127,600lbs. The brass wires, from 78 to 87 000lbs. to the square inch. Copper, from 38 to 44,000lbs. The diameters of the least and greatest wires were, iron, ·014 inch, and ·205 inch; brass, ·070 and ·267 inch; copper, ·019 and ·285 inch.

The finer wires bear greater weights, in proportion to their areas, than the coarser ones, because the particles of the former are compacted through the whole cross section, while those of the latter, for a certain depth only, are thus forced together.—*Ann. de Chim. et de Phys.*

CHEMICAL EXAMINATION FOR THE DETECTION OF ARSENIC.

Sir,—I am induced to send you the following particulars of an investigation I have been lately engaged in, because some circumstances were presented during the analysis which might have led to an erroneous conclusion, had they not been followed up closely; and also, because I think it desirable that, in an inquiry so important, every thing which tends to error should be pointed out as soon as possible, in order to prevent its injurious effect. Arsenic is a poison which the chemist is called upon, too frequently, to detect—many tests have been proposed, some altogether useless, and none to be absolutely depended on; not even the sulphuretted hydrogen test, unless it is followed by the actual reduction of the metallic sulphuret. This will, I hope, appear satisfactory to all your readers who may be inclined to peruse this paper. The errors which I allude to are these:—1st, It may happen that a green will be produced on adding to a liquid suspected to contain arsenic, sulphate of copper and an alkali, even though it should be eventually proved to have none in solution; and 2dly, sulphuretted hydrogen will occasionally give rise to a yellow appearance in a similar fluid, having every appearance of sulphuret of arsenic. But I will state my experiments in a detailed manner. A few days since I received the contents of the stomach of a young woman, who had died evidently from the effects of some metallic poison, indeed, a few hours before her death she had confessed to the surgeon that she had taken a large quantity of arsenic, still it was considered desirable that the stomach and its contents should undergo a chemical examination, it was accordingly sent to me; having, however, failed in getting evidence of arsenious in the contents of the stomach, I next proceeded to experiment on the stomach itself, which I did not receive till eight days after the death of the woman. When it was brought into my laboratory it was in a

state of decomposition: this circumstance rendered it probable, that there was very little arsenious acid present, since it is the property of this poison to preserve from decay the bodies of those destroyed by it. The antiseptic effects frequently extend to the whole body. The stomach and intestines of persons who have died from arsenious acid, have been found entire and firm at the distance of 12 and 20 months after death, and in some of these instances the poison was detected.—(See *Edinburgh Phil. Journal*, vii. 381.)

The following experiments were, however, made to ascertain whether any did exist in the stomach in question:—

1st. Portions of the stomach which seemed in an inflamed state, and to which there were adhering minute specks of a white substance, that seemed to resemble arsenic, were detached and boiled for some time with distilled water, to the filtered solution; in three test tubes were severally added ammoniaco-nitrate of silver, ammoniaco-sulphate of copper, and bichroniati of potash; from the first a white precipitate fell down (chloride of silver), and when it had subsided, another drop of the solution of silver with ammonia, threw down a precipitate in which a tinge of yellow was perceptible; from the second a precipitate of a dull green colour fell down; and in the third no change was produced, either before or after boiling.

2d. The remainder of the filtered solution was acidulated with acetic acid, and a current of sulphuretted hydrogen transmitted through it for a quarter of an hour, it became muddy, but when the excess of sulphuretted hydrogen was driven off by boiling, no yellow precipitation ensued, even after standing some hours; and when, at the expiration of that period, it was passed through a filter, nothing remained behind, so it may safely be concluded that no arsenious acid as present: yet it will be observed that both ammoniaco-nitrate of silver, and ammoniaco-sulphate of copper, seemed to indicate otherwise; the former by the yellow coloured, and the latter by the green precipitation. I suspect the yellow to have been caused by the presence of some phosphate, and the green by some animal principle; the facts, however, prove Dr. Christison's views to be correct. —(See Christison on Poisons.)

3d. The stomach itself was then put *into a clean saucepan*, and boiled for three hours with distilled water, which was then poured off, and the stomach again digested for an hour with distilled water made alkaline by ammonia; by this means if any arsenious acid had been present, it must have been dissolved. The watery solution was evaporated to dryness at a temperature under that of boiling water, and the solid residuum boiled for half an hour with eight ounces of distilled water: by this means, after filtering through blotting paper, a yellow and nearly clear solution was obtained, the solid matter on the filter was then washed with an alkaline liquor, and the washings added to the before-mentioned alkaline solution.

4th. A small quantity of this yellow solution was put into six test tubes: into one a few drops of weak sub-carbonate of potash was dropped, and then immediately a few drops of sulphate of copper carefully prepared and purified from iron —the liquor became of a faint blue colour, but these was not the least precipitate; into the second and third tubes, ammoniaco-sulphate and nitrate of copper were dropped, but with no result.

5th. Into the fourth test tube a little sub-carbonate of soda was added, and then boiled; afterwards a drop of nitrate of silver, a whitish brown precipitate fell down into the fifth tube, a little sub-carbonate of potash was added, and then a stick of nitrate of silver dipped in, the precipitate, as before, was whitish brown: into the sixth tube ammoniaco-nitrate of silver was dropped, this threw down a white precipitate; after this had subsided, a further addition caused no yellow, but in the course of half an hour the whole liquor assumed a pink hue, owing probably to the pressure of animal matter.

6th. Some of the liquid was put into a wine glass, and the end of a glass rod being dipped into ammonia, and the end of another into nitrate of silver, they were brought into contact just below the surface of the fluid, but no yel'ow appeared, when the same experiment was made with a liquid with which arsenious acid had been previously mixed, although muriate of soda was purposely added, yet the yellow arsenie of silver was distinctly desceptible, and this seeme the best manner of applying the nitrate of silver test, but it completely failed in giving evidence of arsenious acid in the present instance.

7th. Bichromate of potash was also

tried several times, and under different circumstances, but with no effect.

8th. A stream of sulphuretted hydrogen was next passed through the alkaline liquor for ten minutes, and the solution evaporated to one half, having been previously filtered; now, had any arsenious acid been taken up by the ammonia, it would still have remained in solution, under the form of a sulphuret, and would have passed through the filter, but the yellow sulphuret of arsenic would have made its appearance on the addition of an acid; nothing of the kind, however, took place, and hence it was quite evident that no arsenic was present.

9th. It now only remained to pass a current of sulphuretted hydrogen through the watery solution; it was accordingly filtered and acidulated with acetic acid, but it was found impossible to obtain a clear liquid; the gas was, however, passed through it for twenty minutes, when the whole became of a *dirty yellow colour;* this yellow, I was satisfied, was not produced by sulphuret of arsenic, but in order to put the matter beyond the reach of doubt, it was boiled, and then made strongly alkaline by ammonia: here, as before, if sulphuret of arsenic had been present, it would have been dissolved by the alkal, and the addition of an acid would cause it to be deposited of a yellow colour; it was accordingly passed through a filter, and to the clear liquid hydrochloric acid was added: after heating for a few minutes, a *flocculent precipitate gradually subsided, having a faint yellow colour;* this might, by some, have easily been mistaken for sulphuret of arsenic, but when it was carefully dried a portion was burnt, and from the smell it emitted, was proved to be animal matter; and when a portion was heated in a small dry tube, with black flux, no appearance of sublimation was observed, nor was there that peculiar garlic odour emitted, which is always the case when arsenic is sublimed.

Thus it was safely inferred that there was not the slightest trace of arsenic either in the stomach or its contents.

I forbear from any further comment, as I shall already have trespassed too much on your time, but if you think what I have written worthy of publication, you will oblige me by inserting it in your valuable periodical at your earliest convenience.—Yours, &c.

HENRY M. NOAD.

MACHINE FOR SPREADING INDIA-RUBBER UPON CLOTH. PATENTED BY WILLIAM ATKINSON, OF LOWELL, MASSACHUSETTS.

The cloth, says the patentee in his specification, to be coated with India-rubber, is to be made into an endless web. This web is passed around cylinders which are made to revolve, and the dissolved caoutchouc or India-rubber, is spread upon the endless web by the aid of a third cylinder, placed parallel to, and nearly in contact with, one of the cylinders around which the endless web passes.

I make a frame of wood; into the lower parts of this frame, uprights are mortised, which serve to support a rail on each side, leaving, however, the sills sufficiently clear within the uprights to form a railway upon which the rollers of a carriage may traverse back and forth.

Upon suitable supports, at one end of this frame, there are placed two cylinders of metal, of cast iron, of one foot in diameter, and two feet nine inches long. The axes of these cylinders are parallel to each other; around the inner cylinder the web to be coated passes; and the outer cylinder is made adjustable by means of screws, or otherwise, so that it may be brought into contact with, or removed to any required distance from, the web, or cloth. These cylinders are geared together by means of toothed wheels upon their shafts.

The second, or carriage cylinder (also of metal), around which the endless web passes, is supported upon a carriage, furnished with wheels, or rollers, which run upon the lower rails or sills. When used as a drying cylinder, it should be three feet. A windlass is placed at the back end of the frame, from which ropes pass to the cylinder carriage, serving, by means of a winch, to draw the carriage, so as to render the cloth taut. Steam is to be admitted into the cylinder through a hollow gudgeon.

In order to apply the solution to the cloth, &c., and to confine it to the proper width, we fit two checks, or pieces of wood or metal, so as to rest upon the two contiguous rollers, one at or near each of their ends; and these, when in their places, convert the rollers into a trough, or hopper, for containing the solution. The distance of these pieces from each other is regulated by attaching them together by means of a frame, or rod, at their upper sides, so that they may slide, and be affixed in their places by thumb screws, or otherwise.

To prevent the cloth adhering to the outer roller, among other methods, wet sponges or brushes may be laid along it.

OF EXPERIMENTS MADE BY THE COMMITTEE OF THE FRANKLIN INSTITUTE NNSYLVANIA ON THE EXPLOSIONS OF STEAM-BOILERS, AT THE REQUEST OF REASURY DEPARTMENT OF THE UNITED STATES.

(From the *Journal of the Franklin Institute.*)

(Concluded from p. 190.)

Plate VI. Fig. 1.

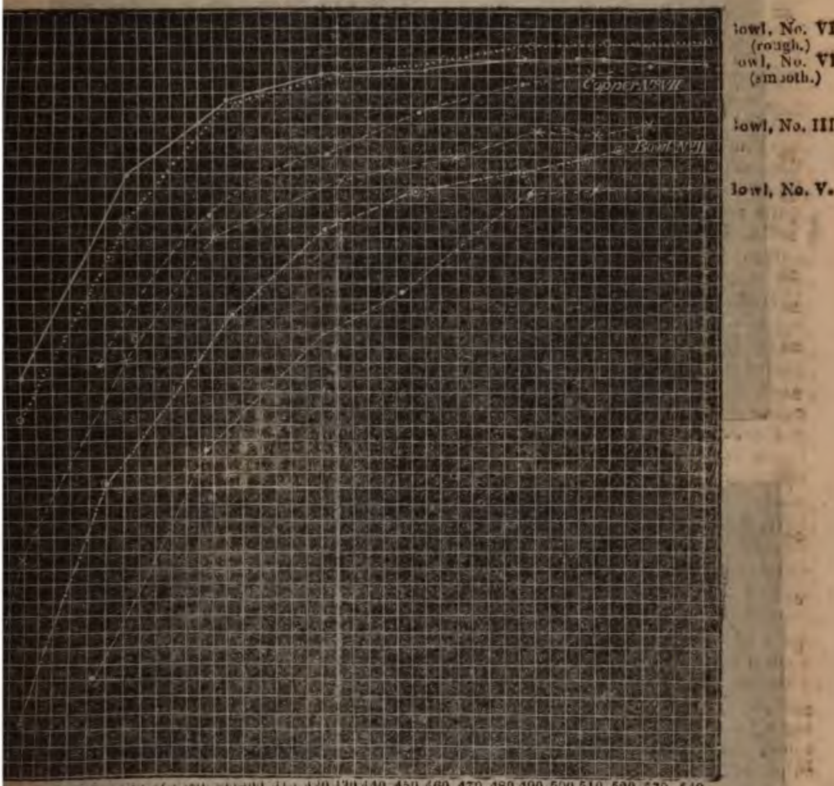


Fig. 2.

[The engravings on this and the following page were referred to in No. 170.—See p. 166.]

Plate V. Fig. 2.

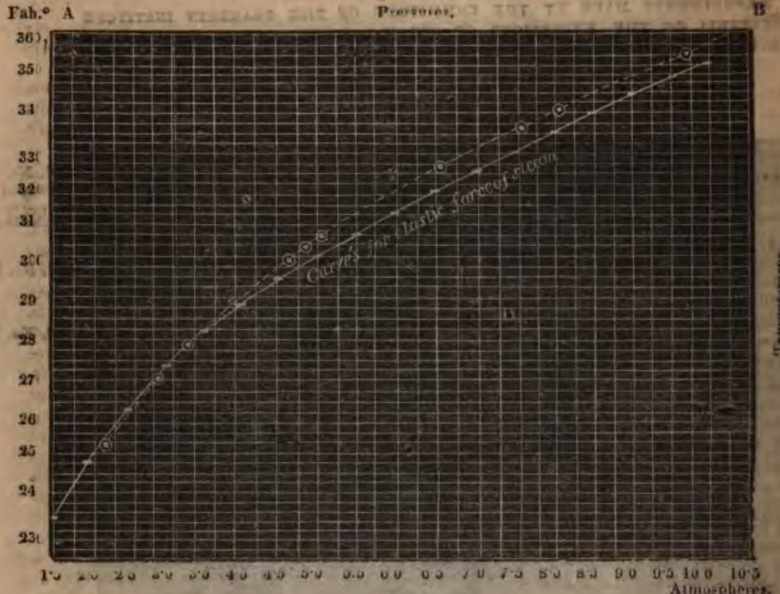
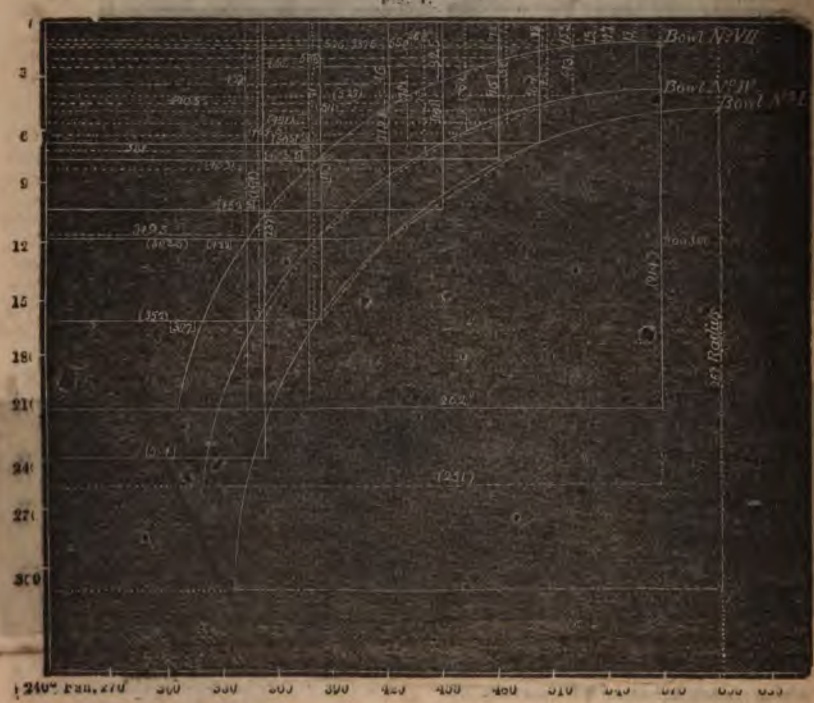


Fig. 1.



VIII. *To observe accurately the sort of bursting produced by a gradual increase of pressure within cylinders of iron and copper.*

It has been contended by some, that ruptures produced by a gradual increase of pressure within steam-boilers do not bear the character of explosions, but that a mere rending takes place, giving escape to the contents. This has been assumed to be especially the case with copper boilers. To make the observation required by the above question, cylinders of iron and copper were prepared, of sufficient size to make a small thickness of material answer for rending by a pressure which was easily attainable. Two experiments made, one with an iron and another with a copper cylinder, afforded so direct an answer to the query, that it was not deemed necessary to carry the experiments further, especially as they were tedious, and not without danger. A further experiment of the same tenor resulted from a trial of Perkins's assertion in regard to the effect of making an opening in a vessel containing water, and heated to a high temperature.

The boilers used were cylindrical, $8\frac{1}{4}$ inches in diameter, and 10 and 12 inches respectively in length, of iron ·02 inch thick, and of copper ·03 inch thick, having iron heads ·05 inch thick, to which the convex surface was fixed by iron rivets, placed nearly touching each other. A single opening in the middle of one of the heads of each boiler was provided to introduce the water, and was furnished with a screw, into which to insert a tube and piston, connected with a small spring weighing-machine, which is represented at *a* in the wood-cut below. Upon the cylinder of this machine a ring was placed, which was moveable along the cylinder by a slight pressure: this ring was forced towards the end of the cylinder nearest to the boiler-head, as the spring was bent and remaining in its place when the spring relaxed, served to register the maximum pressure to which the piston had been exposed previously to observing it.

The iron boiler was placed in a heavy cylinder of wrought-iron, which served as a furnace, the axis of the boiler being nearly horizontal, and that of the furnace cylinder vertical. The boiler, having been half filled with water, was placed upon a fire of charcoal, and when the water boiled the register-machine for the pressure was screwed in.

The place selected for the experiments was in a deserted quarry on the banks of the Pennypack, near Holmesburgh. The high bank served as a protection, by the aid of which the experiments were viewed with little danger. A wire and cord were attached to the head of the boiler, to draw it from the fire when the latter required to be replenished. A leak in the riveting of the iron boiler allowed so much steam to escape, that the boiler did not give way on the first trial. As soon as the escape of steam was observed to cease, the boiler was removed from the fire and again half filled with water. The fire was urged, and the boiler settled lower into it, and by once replenishing the fuel, without removing the boiler, an explosion was produced. Part of the Committee were engaged in observing the progress of the experiment at this moment. The fire was near the middle line of the boiler, burning not strongly near that line, but very rapidly below the boiler; the steam issued freely through the leak before alluded to, and the whistling sound which it produced, and which had increased gradually in strength as the experiment progressed, seemed constant. The length of time during which the steam had escaped showed the water to be low, and induced the supposition that a second time the object would fail, when an explosion occurred. The explosion tore off one of the heads, *bc*, of the cylinder, projecting the other parts of the boiler in an opposite direction, carrying with them, for a portion of the distance, the iron cylinder forming the furnace, and scattering the fuel in every direction. The report attending the explosion resembled that from a small mortar (*eprouvette*) fully charged, the steam mixed with the smoke was not considerable in quantity, and few marks of water were to be seen. The boiler-head was thrown 15 feet, the boiler and spring-register about 6 feet, and the furnace, weighing about 45lbs., was overturned and carried 4 feet. The pressure indicated by the register was $11\frac{1}{2}$ atmospheres.

In examining the boiler it appeared that

the head *b*, which was thrown off, had first struck against the iron furnace, which had deflected it outwards; this is shown by the indentation, *bc*, in the figure. This head was forced off all around in the line of rivets which attached the head to the boiler, the metal remaining between the rivets being less than the space occupied by them. The convex surface and the other head were thrown likewise against the furnace, and the head indented at *de*, overturning the furnace and carrying it 4 feet, as already stated. The boiler finally struck against the side of the bank of earth. The piston of the weighing-machine was somewhat bent in the experiment.

The circumstances of this experiment show that the steam rose quite gradually on account of leaks in the boiler, increasing, probably, more rapidly as the quantity of water diminished, the intensity of the fire meanwhile increasing. That at a certain period the tension within had attained about 11 atmospheres, when the boiler *exploded violently*.

The accompanying figure will serve to give an accurate idea of the appearance of this boiler after its rupture.

The cylinder of copper, before referred to, was next put in the place of the iron boiler, and the fire again kindled; the general arrangements being as before described. This boiler being longer than the former, would not descend so far into the furnace, and an attempt to raise the steam sufficiently high to burst it failed: there was a considerable leak in the junction of the curved surface with one of the ends. When the water was nearly exhausted, the fire having passed its period of greatest heat, the cylinder was removed and water again introduced, filling about three-fourths of its capacity. A new furnace was constructed of stones, allowing the boiler to rest more closely upon the fuel, and affording a screen from the wind, which was blowing quite strongly. The part of the boiler in which the leak had been observed was turned downwards, but a similar escape was found for the steam in the part now uppermost. The tension of the steam appeared to increase very slowly, and the fire passed its best action without effect; it was renewed, and as the water became lower the tension of the steam increased considerably. As before, nothing remarkable occurred previous to the instant of explosion, and the members of the Committee employed in the experiments were engaged in observing the boiler at the instant it exploded. A dense cloud of smoke and flame, capped by steam, rose from the pit; the stones and combustibles were widely scattered, and the boiler was thrown, in a single mass, about 15 feet from the furnace. The noise attending this explosion was like that from the firing of an 8-inch mortar.

The boiler was rent as shown in the accompanying figure, giving way in an irregular

line just above the probable water line on one side of the boiler, but not conforming to it. *d* and *b* were the lowest points in the two heads before the explosion. The sheet of copper was torn from the heads, unrolled and irregularly bent, adhering to the heads for only a short distance near the top of each; and the heads were bent outwards. The thickness of the copper along the line of rupture varies from ·025 to ·035 of an inch, and the metal appears to have been highly heated at one end of the torn portion. The piston of the spring-gauge was bent, the screw which attached it to the boiler broken and the whole instrument otherwise injured; it appeared that the wire intended to draw the boiler off the furnace had slipped and impeded the action of the piston, so that no re-

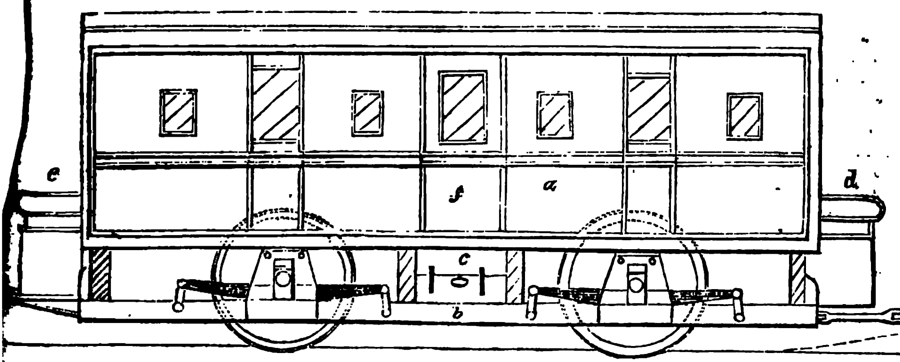
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 673. SATURDAY, JULY 2, 1836. Price 3d.

CURTIS'S SAFETY RAILWAY-CARRIAGE.

Fig. 1.



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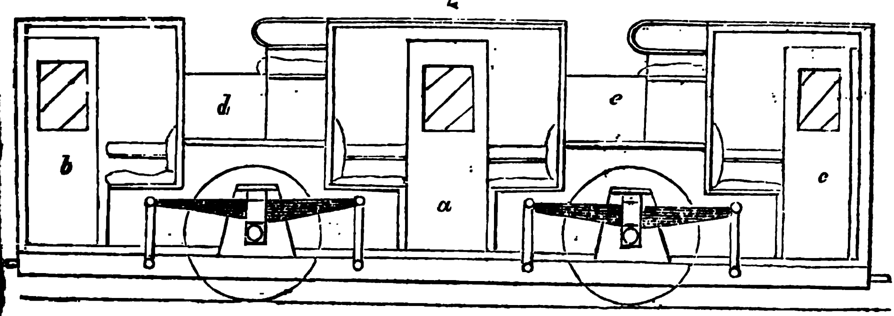
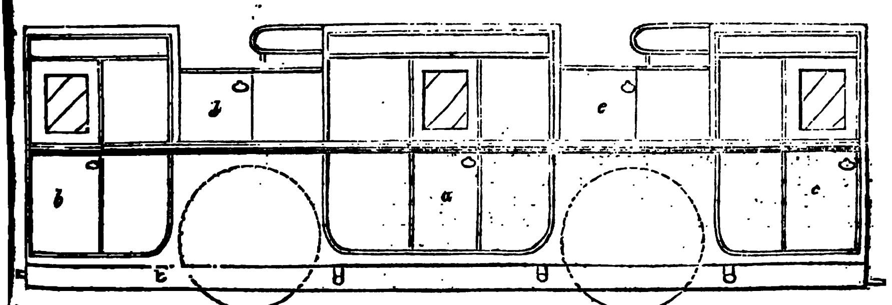


3.



CURTIS'S SAFETY RAILWAY-CARRIAGE.

Sir,—Thanking you for your notice of my safety-break (published in No. 670), I have now to request the additional favour of your introduction to the public of the safety-carriages invented and constructed by me for the London and Greenwich Railway Company. A train of six of these are now upon the line; and the whole establishment of the carriages of the Company are in the course of being altered to the same plan. The alteration, it will be seen, consists principally in the carriage, which is inverted or suspended. The frame lies within four inches of the rail when loaded, which is sufficient to clear all the projections at the crossings; while in the event of the axle of the wheels breaking, the frame drops upon the rail and becomes a sledge, the friction of which, even when empty, will be sufficient to pull up the engine. In the event, again, of the wheel running off the rail, the frame, which projects eight inches beyond the wheel, falls upon it, and the same result follows, namely, that the friction stops the train; joggles are fixed to the front and side rails of the frame which act as flanges, and thus hold the frame on the rail. Another valuable feature of this arrangement is, that at each end of the line, or at each stopping-place, supplemental side-rails will be fixed, which will be moveable; so that in the event of the train not stopping with the necessary precision—whether from the rails being wet, or from the engine running away with the train, or from any other cause—the carriages will run upon the side-rails, being supported by the frame and not upon the wheels. I have tried this with a single carriage, and have found it an admirable and perfect means of bringing it to a stand. The position of this side-rail is shown by the dotted line *z* in fig. 1. Another feature of some importance connected with this train is the mode of connecting the carriages; there is but one buffer, and that to the leading carriage, a draught-spring being affixed to the engine, and both connected together by an inflexible rod. By this arrangement all tremor and vibration is avoided; there is neither collision nor jar in starting, stopping, or moderating the velocity; there is, besides, decidedly less noise than in the old carriages; and, moreover, the carriages being connected by inflexible bars throughout, this supplies the means of carrying ten more passengers upon the same carriages, viz. outside, between each carriage. I find, from the reduced height, that the train loads and unloads in less than half the time required upon the old system. It is further important to observe, that all the old carriages and bodies, of whatever construction, may be altered to the new mode at a very trifling cost.

Fig. 1 is an elevation of the carriages now upon the line. *a*, the body; *b*, suspended carriage; *c*, steps; *de*, outside seats; *f*, door; the interior is fitted up in the usual omnibus style.

Fig. 2. Section of an improved carriage upon the same system, consisting of five bodies. *a*, a coach-body; *b c*, chariot-bodies, the flooring being at once upon the frame ten inches from the ground; *de*, either outside seats, or raised bodies above the wheel; the floor of the same height as in the present carriages. For a long journey, such as from London to York or Birmingham, I should recommend the bodies, *de*, to be converted into holds for luggage, placing thus the heaviest load immediately over the wheels; and thus the roof may be either converted into a deck for outside passengers, or a roof may be added, and it will become an omnibus-body or second-class coach. In this arrangement it will be perceived that the springs are placed over the axle, a method to be recommended in all cases where practicable.

I may observe, that the engines start with the load without the least difficulty, notwithstanding the whole weight is put in motion at the same moment. I mention this merely to meet any objection which may suggest itself on that head.

Fig. 3 is an elevation of fig. 2.

I remain, Sir,
Your obedient servant,
W. J. CURTIS.

11, Grange-road, Bermondsey,
June 15, 1836.

APPLICATION OF STEAM TO AGRICULTURE.

Sir,—Some incorrect statements having appeared in several provincial papers, relative to a recent exhibition near Bolton-le-Moors, of the application of steam to bog cultivation, as invented by Mr.

Heathcoat, I should feel obliged by the insertion of the accompanying remarks, on the part of myself and those gentlemen who accompanied me to witness this interesting experiment.

I am, Sir,
Your obedient servant,
HENRY HANDLEY.

26, Pall-Mall, June 13.

Steam-Ploughs.

The adaptation of inanimate power to the tillage of the soil must evidently have been considered by practical men to present almost insuperable difficulties, or steam would, probably, long since have been substituted for horses and oxen, as the motive power of agricultural implements. Certain light operations of the farm, such as thrashing, churning, chaff-cutting, &c., which could be performed by fixed power, have partially occupied the attention of mechanics, and suitable machinery driven by water, wind, or small steam-engines, has to some extent been advantageously used for such purposes. But the idea of a "steam farm," of a farm to be altogether cultivated by steam, in lieu of animal power, has hitherto been treated as visionary and absurd, except by a few individuals, and one or two agricultural societies, who have enforced, in their publications, the practicability and importance of applying steam to effect the more laborious operations of agriculture.

This desideratum is at length accomplished. Mr. Heathcoat, M.P. for Tiverton, the ingenious and well-known inventor of the lace machinery, has the merit of having conceived and planned this additional and remarkable contribution to science, and to the wealth of his country. The invention, after years of costly experiment, has been matured and perfected through the enterprising liberality of Mr. Heathcoat, assisted by the mechanical ingenuity and perseverance of Mr. Josiah Parkes, civil engineer, whom he selected to carry his designs into effect. The first machine has been constructed expressly for the cultivation of bogs, and has, for some months, been practically and successfully worked in Lancashire, on Red Moss, near Bolton-le-Moors.

During the Whitsuntide recess of Parliament, a numerous assemblage of gentlemen from different parts of the country attended to witness an exhibition of this novel and interesting invention; amongst whom were Mr. M. L. Chapman, M.P., Mr. T. Chapman, Mr. H. Handley, M.P., Mr. J. Featherstone, of Griffinstown-house, Westmeath (an enterprising and successful bog-reclaimer), Mr. F. Brown, of Welbourn, Lincolnshire, Mr. James Smith, of Deanston, near Stirling (well known to the mechanical world by his ingenious inventions, applied both to agriculture and manufactures), Mr. B. Hick and Mr. P. Rothwell, engineers, with other experienced judges of mechanical contrivances. These gentlemen were unanimous in pronouncing the invention to be the germ of great improvements in the science and practice of agriculture, as well as eminently fitted for the particular purpose to which it has, in the first instance, been applied. Two ploughs of different construction were put in action, to the admiration of the spectators; particularly the one last invented, which is double-acting, or made with two shares in the same plane, so that it returns at the end of a "bout," taking a new furrow, without loss of time. The perfect mechanism of this plough—the action of the working coulters and under-cutting knives, which divide every opposing fibre of the moss—the breadth and depth of the furrow turned over—the application of a new and admirable means of traction, instead of chains or ropes—together with the facility with which the machine is managed, and the power applied to the plough, especially interested and surprised all present. The speed at which the plough travelled was 2½ miles per hour, turning furrows 18 inches broad by 9 inches in depth, and completely reversing the surface. Each furrow of 220 yards in length was performed in somewhat less than three minutes, so that in a working day of twelve hours, this single machine would with two ploughs turn over ten acres of bog land!

The machine which bears the steam-engines is itself locomotive; but as the ploughs are moved at right angles to its line of progress, not dragged after it, the machine has to advance only the width of a furrow, viz. eighteen inches, whilst the ploughs have travelled a quarter of a mile; in other words, the machine has to be moved only eleven yards, in the

time that the ploughs have travelled five-and-a-half miles, and turned over a statute acre of land. This is, in truth, the prime distinguishing feature of the invention; it is the contrivance on which the genius of its author is more particularly stamped, and which seems to be essential to the economical application of steam to husbandry; for it is evident, that were it requisite to impel the machine with a velocity equal to that of the ploughs, by dragging them with it, a great proportion of the power of the engines would be uselessly expended.

Another valuable property appertaining to the machine, and which conduces greatly to its economy as a bog cultivator is, that it requires no previous outlay in the formation of roads, no preparation of any kind further than a drain on each side of it. That a locomotive machine of such great dimensions and power could be so constructed as to travel on mere raw bog, was an excellence the more appreciated as it was unexpected by those persons who are conversant with the soft, unstable nature of bog. The Irish gentlemen present also pronounced Red Moss to be a fair specimen of the great mass of the flat, red, fibrous bogs of Ireland, and that neither the machine nor the ploughs would have any difficulties to encounter in that country which had not been already overcome on Red Moss, the field of experiment. The engines are capable of working up to fifty horses power, but the operations subsequent to ploughing will require a small force compared with that necessary for breaking up the surface of the bogs, to the depth and at the speed effected by these ploughs. The power consumed by each plough is estimated at about twelve horses, and the weight of the sod operated upon by the plough, from point to heel, is not less than three hundred pounds. The boiler is of unusually large dimensions for locomotive engines, being suited to the use of peat as fuel, so that the culture of a bog will be effected by the produce of its drains. At Red Moss, however, coals are so cheap, being found contiguous to and even under it, that they are used in preference to turf. Eight men are required for the management of the machine and the two ploughs, or at the rate, nearly, of one man per acre; but it must be understood that this number of men will only be required for the first heavy process, and has no relation to any subsequent operations in the cultivation of bogs, nor to the application of the invention to the culture of hard land.

After passing a sufficient time on the Moss to witness the exhibition of the ploughs, and the various other functions and properties of the machine, the party expressed to Mr. Heathcoat the extreme pleasure they had received, and their earnest hope that he would extend the sphere of his exertions by applying the invention to the culture of stiff clay soils; and more especially to carry into effect those important operations of sub-soil ploughing and improved drainage recently introduced to the agricultural world by Mr. Smith, of Deanston. To effect these processes, great power is essential, and it was evident that Mr. Heathcoat's invention was equally well adapted to them, and would be attended with results no less important than those which will arise from its application to the reclamation and culture of bogs.—*Morning Chronicle.*

THE SILICA SOAP, AND WASHING WITH PIPE-CLAY.

Sir,—I have just observed in your Magazine for last month an article from Dundee, relative to the use of pipe-clay as an auxiliary to soap. In corroboration of the facts stated therein, I beg leave to say, that I and some of my friends have for many years been in the habit of using a silicious clay or species of soapstone, both in solution with water and in combination with soap, and have found it to possess such valuable detergent qualities, as to effect a considerable saving in that article.

I am not aware whether pipe-clay, or a clay such as mine, be the better material; the former you know is highly aluminous, while the principal constituent of that on my land is silex, and differing, I should think, very little, if at all, from the pulp of flint; for the use of which, in the manufacture of soap, you noticed in a late Number that a patent had been obtained.

I am, Sir,

Your obedient servant,

I. S.

Dublin, June 20, 1836.

STEPHENS' IMPROVED FOUNTAIN INKS.

Sir,—Inkstands upon the principle of the bird's water-fountain have long been in use, particularly as recipients for red ink. Although this form of inkstand possesses many advantages, still it is liable to several objections; from the particular conformation of the orifice, a very shallow body of ink is contained in the well: being entirely open, it is also constantly covered with a film of dust, which, as it subsides to the bottom, is continually being taken up by the pen, the remaining portion forming a dirty incrustation about the trough. From the shallowness of the well, fine pointed pens are also frequently injured by striking against the glass at the bottom in hasty dipping.

An improvement in this form of inkstand has recently been introduced by Mr. Henry Stephens, in which he has retained all the advantages of the old fountain-inks, and obviated the objections to which they have been liable.

A sketch of one of Mr. Stephens' improved fountain-inks accompanies this paper, by which it will be seen, that the aperture for the pen is a perpendicular, and not a horizontal orifice, and instead of dipping into a *shallow well*, the pen is inserted obliquely into the body of the ink.

This inkstand was invented by Mr. Stephens for his new *writing fluid*, for which it is particularly adapted. This valuable substitute for ink possesses characters long held to be desirable by the writing world.

The numerous defects existing in the common writing inks, have been the subject of continual complaint from time immemorial, but which, since the genera introduction of steel pens, have been felt so much, that many persons who would prefer metal pens, from the uniformity which they give to the text, have been compelled to abandon them from the difficulty they find in their use, owing to the decomposition and want of fluidity in the inks. Mr. Stephens, struck with the importance of the subject, turned his attention to the investigation of the matter, and after a great number of experiments continued for a long period of time, he has succeeded in producing one of the best inks ever submitted to the public. Mr. Stephens' writing fluid is remarkable for the ease with which it flows from and follows every stroke of the pen, for its bright and distinct blue colour when first written with, and the superior blackness which it afterwards invariably acquires.

Some doubts having arisen, or rather, insinuations having been industriously circulated, as to the durability of this ink, Mr. Stephens very justly observes—"The permanence of a colour depends very much upon the weakness or strength of the affinity of its combinations. If to any compound you introduce substances having a stronger affinity to either of the combined matters than the one with which it is united, you disturb the composition and alter its character. If any of the materials are easily affected by surrounding influences, combining with, or being attracted by them, the composition is more or less liable to change. To illustrate the force of the above statements, I need only advert to the composition of common ink, which is a combination of gallic acid with sulphate of iron. Interpose any substance which subtracts or

displaces either of the above substances, and you impair or weaken the colour. Gallate of iron is a coloured or black compound; oxalate of iron is comparatively colourless. Oxalic acid having a stronger affinity for the iron than the gallic acid, displaces the latter, and changes the composition from a black to a colourless impression, and effaces the record. Many other influences attack the vegetable principle, subtracting and dissipating it, leaving the remains a brown oxide of iron: such is the action of the sun, the slow operation of time, marine influences, and the operation of water in washing ink-stains on linen, &c., proved by the iron-mould remains. The practice of reviving old records by brushing them over with tincture of galls, evidences the departure of the vegetable principle, and the remains of the metallic oxide."

The above sketch tends to show that common ink depends for its colour upon very simple affinities, which are easily disturbed, both by chemical agencies and by surrounding influences, and that a colour having more fixed and complicated affinities, would be less liable to such influence, and would consequently be more durable. Some interested individuals have asserted, that *the writing fluid* will corrode or injure the paper or textures to which it is applied, upon which point Mr. Stephens makes the following remark:—

"It is well known that papers, &c., upon which records have been written, have been destroyed by the ink, and that, not by any immediate effect, but after the lapse of years. And how is this caused? I have seen no statement satisfactorily accounting for it. A hasty, but very erroneous solution is generally given—namely, that it is the acid in the ink, and this assertion has generally been deemed satisfactory; but I shall have no difficulty in showing that such is not the case. In the first place, there exists in common ink no uncombined acid.*

"If uncombined acid existed in ink sufficiently strong to destroy the paper, the effects would be early exhibited, and consequently be of less importance, as the record could be more easily restored. The real cause of destruction is as follows:—The affinity between the vegetable and mineral principle is, as I have shown, slight—the combination is easily disturbed, and this, which renders the composition liable to fade, gives to it also its insecurity. The action of the sun, time, and various other causes, abstract and dissipate the vegetable principle. The iron is thus gradually left uncombined. It is a property of almost every substance to seek for combination: deprived of one substance with which it had been united, it attracts to it another; thus the iron, deprived of the gallic acid on which its colour depended, and in which state of union it had no corrosive properties, begins to attract oxygen, and, as an oxide of iron, is more or less injurious to the textures on which it had been written. If the iron exists in small proportions, the evil is small; but if it abounds in the composition, it is more strongly corrosive. Without being aware of the above cause, the fact has been known that inks containing too large a quantity of iron soon become brown. There are not wanting other facts to support this opinion. Black dyes, the composition of which is the same as ink, are well known to be more destructive to cloth, &c. than other colours. '*Black dyes perish the cloth*,' is a very common expression, and results from the decomposition of the colouring ingredients, and the corrosiveness of the mineral remains. From this brief analysis, the inference is tolerably plain, that if the ingredients composing a colour are united by stronger affinities than common ink, such colour will be both more permanent and more secure."

Guided by these truths, Mr. Stephens has been eminently fortunate in the selection of substances suitable for the production of a very superior *writing fluid;* but he has attained perfection by a minute attention to the proportions, and by being careful to use all the ingredients in a state of extreme purity. Few inventions have been so gratefully received, and so extensively patronised in a short space of time, as Mr. Stephens' writing fluid; one consequence of this has been, that imitators and adulterators have sprung up, like mushrooms, with various mixtures, pretending to possess the same good qualities as the original article.

I have critically examined most of these imitations, but have met with none yet that will compare with the *writing fluid,* either in point of colour, fluidity, or permanence. The following simple experiment will put the claims of this and similar productions to a fair trial:—

* Unless when inks are made with a proportion of vinegar.

Having written on a piece of paper with Stephens' and other fluids, pour over the writing a small quantity of a bleaching solution (chloride of lime), and the effect will be conclusive.

An objection has been made to the *writing fluid*, that, being more fluid, it necessarily sinks into the paper more than common ink; but I consider this, in a moderate degree, rather a virtue than a defect. It is quite evident that a colour which is intended to endure, should combine with, and in some degree dye, the substance to which it is applied. If it sits upon the surface like varnish, liable to be erased by slight scratching, and almost by friction, it cannot be expected to retain its impression strongly, any more than we should expect our coats, dyed on the outer surface only, to be durable in their colour.

A precipitate of colouring matter is liable to take place from all solutions by long standing, but the precipitate from the writing fluid is perfectly soluble; the inkstand should, therefore, be occasionally shaken, which can very easily be done, if the fountain-ink of Mr. Stephens is employed. It will be perceived, by referring to the drawing, that these stands are constructed so as to lessen evaporation; to prevent lodgments of dust; to afford an oblique and more convenient access with grooved rests for the pen; it is also particularly adapted for the occasional *agitation* of the contents.

I have received much personal convenience from the use of Mr. Stephens' writing fluid; and have much pleasure in thus publicly expressing my thanks for the same. Wishing him every success,

I remain, yours respectfully,

WM. BADDELEY.

London, June 9, 1836.

ORNAMENTAL SLATE MANUFACTURE.

Slate has of late years become extensively useful, and its application to new purposes is of every-day occurrence. A Mr. Stirling has for some time been labouring to bring it into use as a material for the manufacture of various articles of furniture, and, from the specimens which we have seen, we think it likely that he will meet with complete success. Tables of all kinds, sideboards, wash-hand stands, and other articles of a similar nature, and which do not require to be often moved (as slate is, of course, heavy), may be made of it, decorated in the most elaborate style. The natural texture of the slate, it has been found, is peculiarly applicable as a ground for the reception of colours; and Mr. Stirling has some specimens of tables with a wreath of flowers round the edge, and a group in the centre, most beautifully executed—the neutral tint of the slate forming an appropriate back-ground. A very beautiful and appropriate application of the article has been made in the formation of door-panels. The General Steam Navigation Company has, we understand, given orders for the fitting up of the saloon of one of its new steam-vessels with these panels, painted with groups of fruit, flowers, and designs of a like nature. Amongst the numerous other articles of slate manufactured by Mr. Stirling, we shall merely particularise his door finger-plates and inkstands, which are extremely beautiful.

THE THREE-PRONG PEN.

Sir,—In your No. 667, I observe that Messrs. Mordan and Co.'s last patent for steel-pens is noticed. The public will, no doubt, derive a great benefit from the use of them, and it must be admitted that Mordan and Co are good makers of these articles; but as to their patent right, I fear it will cost a good deal to defend it. It was certainly rather a bold step of Mordan and Co. to speculate upon a patent under the peculiar circumstances stated by your correspondent. However, I wish they may establish their patent, because I think it would prove whether the late act to amend the patent law be of any benefit or not.

For some years past I have formed several ideas about improving steel-pens, and, although not a pen-maker, I thought that I was, and perhaps am, the first inventor of the *three-prong pen*, for this is the name I gave what is now called the three-nibbed pen—but I think the nib of a pen consists of all its prongs together. About a year ago, after searching almost every place where steel-pens were sold, I could not find any thing approaching my ideas on the subject, which led me to think that I had hit upon something new. I then applied to several of the pen-makers, and examined several speci-

fications at the Inrolment-office, without making any further discovery—until October last, when I waited upon Mr. Mordan, in a confidential manner. After exchanging several remarks about steel-pens, I showed him a plan and model of my three-prong, or writing point (which I have still by me), and he asked me if I meant to allow all the three prongs to touch the paper when writing. I replied, certainly—the third prong was to deposit the ink, when the two main prongs were extended wide, to form large letters, but in small writing it would seldom come in contact with the paper. All that has been said about capillary attraction, &c. I do not think applicable to this subject. Mr. Mordan then said that such a pen, a few months back, would have been worth 1,000*l*. I naturally desired to know why it had lost its value. He then told me of Mr. Gowland; what he had done; and that he had unfortunately allowed his invention to be published by Mr. Carstairs; and although a patent was now out of the question, he meant to make something of it if he could. He also showed me a pen with a piece punched out of the shank, and bent down the back, to form the third prong. Mr. Gowland's plan was a separate piece rivetted on. I pointed out to Mr. Mordan that my mode of making was different both from Mr. Gowland's and his, and that it could safely hold double the quantity of ink. I then left him, desiring him not to use my plan without my consent, saying I had still another point in store, which would appear in another way; and I have neither seen nor heard from Mr. Mordan since.

I believe Mr. Gowland has not benefitted much by his share in the invention; he told me that several pen-makers to whom he had shown the pen, pretended they had a similar thing. This, I believe, they had not; consequently it appears that Mr. Gowland was jockeyed into the act of publishing his invention, to his own loss and the benefit of others.

Your obedient servant,

J. Dickson.

9 Charlotte-street, Blackfriars-road,
June 27, 1836.

DRAFTSMAN'S SCREW-PIN.

Sir,—Presuming that the simplicity of the following contrivance is no objection, I have to beg a corner for it in your valuable Magazine.

I have often found, in using a drawing-board, when I had a sheet of paper laid on each side at the same time, and had occasion to draw on both before taking either from it, that they became woolly (from being rubbed), and, consequently, unpleasant to work upon. I therefore adopted the following method of preventing this evil, and thus now use one board, where I otherwise should have been obliged to have two.

Near each corner of the board a small brass tube was fixed, with a screw tapped in it, so as to take a screw-pin, placed either above or below. One of these pins was fitted into each tube, and the head left rather rough, to take a better hold on the table on which the board might be placed when used.

The engraving, in which A B shows a section of part of the board, and *a* the pin screwed in its place, will supersede the necessity of a further description. If preferred, pins without being screwed, but fitting nicely, would do.

I remain, Sir,

Yours very obediently,

C. E. B., a Subscriber.

AMERICAN LAW OF PATENTS.

Report of a Select Committee of Congress appointed to take into consideration the State and Condition of the Patent-Office, and the Laws relating to the issuing of Patents for New and Useful Inventions and Discoveries.

The promotion of the arts and the improvement of manufactures are the objects aimed at in granting patents for inventions. All civilised nations have provided in some form for the encouragement of inventive genius. England, from whom we derived, originally, most of our notions of national polity, and who has hitherto been considered the "queen of arts," is in no small degree indebted for the distinction to the liberality with which she has always rewarded genius

and science for their inventions and discoveries. Individual munificence and the patronage of wealthy associations, have there, as in France and Germany, done much to supply whatever was wanting in the liberality of the Government. But such patronage is necessarily partial in its operation. It is limited to particular objects, if not to particular individuals. There appears to be no better way of measuring out appropriate rewards for useful inventions than by a general law, to secure to all descriptions of persons, without discrimination, the exclusive use and sale, for a given period, of the thing invented. In this way they will generally derive a just and appropriate encouragement proportioned to the value of their respective inventions. It is not at this day to be doubted that the evil of the temporary monopoly is greatly overbalanced by the good the community ultimately derives from its toleration.

The granting of exclusive privileges was in England originally assumed as a prerogative of the Crown, from which it derived a revenue. It was at first limited to the introduction of manufactures from other countries. Afterwards like privileges were granted for new inventions made within the realm. Like all other regal prerogatives, it was subject to abuse, and Parliament found it necessary to limit and restrain it. This was done by the famous statute of monopolies, passed in the reign of James I. which defined the king's prerogative in respect to the description of grants which might legally be made, and among them were patents for inventions and new manufactures. The very brief reservation of right in the Crown contained in that statute, and the judicial decisions in cases arising under the grants of privileges made pursuant to it, constituted the whole of the English law on the subject up to 1835, when a law was passed by Parliament giving the right to file a disclaimer in certain cases, and containing some other less material provisions.

It is from those judicial decisions that we have derived most of the principles on which our laws on the subject are founded, and which have entered into and influenced the judicial expositions given to them. But the decisions of our courts have been characterised by a more enlightened and liberal application of equitable principles to cases of this description, in a just endeavour to sustain patents for meritorious inventions, instead of seeking to find, in the technicalities of law, a pretext for setting them aside.

Prior to the adoption of the federal constitution, the States, within their narrow limits, could give very little encouragement to inventors by grants of exclusive privileges; and up to that time the arts had made very little progress on this side of the Atlantic. By the constitution of the United States that power was wisely vested in Congress.

The first act of Congress on the subject was passed in 1790. It authorised the Secretary of State, Secretary of War, and the Attorney-General, or any two of them, on application, to grant patents for such new inventions and discoveries as they should deem "sufficiently useful and important." Under that act the board so constituted exercised the power of refusing patents for want of novelty in the invention, or of sufficient utility and importance. This act extended the same privilege to aliens as to citizens. In 1793, it was repealed, and nother act passed, authorising patents to citizens of the United States only, to be granted by the Secretary of State, subject to the revision of the Attorney-General. In 1800, the privilege to take out patents was extended to aliens who have resided two years in this country, and made oath of their intention of becoming citizens of the United States.

The act of 1793, which is still in force, gives, according to the practical construction it has received, no power to the Secretary to refuse a patent for want of either novelty or usefulness. The only inquiry is, whether the terms and forms pres ribed are complied with. The granting of patents, therefore, is but a ministerial duty. Every one who makes application is entitled to receive a patent by paying the duty required, and making his application and specification in conformity with the law. The necessary consequence is, that patents have, under the act of 1793, been daily granted, without regard to the question of novelty, or even utility in the ordinary sense; for it has been settled that the term useful, as used in this statute, is only in contradistinction to hurtful, injurious, or pernicious. This construction (that no right is conferred to refuse a patent) has been given to the law by the department charged with the duty of granting patents, not so much probably from any necessary and unavoidable import of the terms of it, as from a disinclination to exercise a power of so much importance, in cases where it is not clearly and distinctly granted. And it may be reasonably doubted whether it was the intention of Congress to confer such a power on the Secretary of State alone, since no provision is made for an appeal or other remedy for an incorrect decision adverse to the applicant. Besides, any person occupying that station might be supposed as little qualified by an acquaintance with the appropriate branches of science or of the arts, to decide such questions, as any other officer of the Government. And were he to undertake the task of such an examination as would be necessary to a decision in each case, he

would have little time for other official duties.

Under the act referred to, the Department of State has been going on for more than forty years, issuing patents on every application, without any examination into the merit or novelty of the invention. And the evils which necessarily result from the law as it now exists, must continue to increase and multiply daily, till Congress shall put a stop to them. Some of them are as follows:—

1. A considerable portion of all the patents granted are worthless and void, as conflicting with, and infringing upon one another, or upon public rights not subject to patent privileges; arising either from a want of due attention to the specifications of claim, or from the ignorance of the patentees of the state of the arts and manufactures, and of the inventions made in other countries, or even in our own.

2. The country becomes flooded with patent monopolies, embarrassing to *bona fide* patentees, whose rights are thus invaded on all sides; and not less embarrassing to the community generally, in the use of even the most common machinery and long-known improvements in the arts and common manufactures of the country.

3. Out of this interference and collision of patents and privileges, a great number of lawsuits arise, which are daily increasing in an alarming degree, onerous to the courts, ruinous to the parties, and injurious to society.

4. It opens the door to frauds, which have already become extensive and serious. It is represented to the Committee that it is not uncommon for persons to copy patented machines in the model-room; and, having made some slight immaterial alterations, they apply in the next room for patents. There being no power given to refuse them, patents are issued of course. Thus prepared, they go forth on a retailing expedition, selling out their patent rights for States, counties, and townships, to those who have no means at hand of detecting the imposition, and who find, when it is too late, that they have purchased what the venders had no right to sell, and which they obtain thereby no right to use. This speculation in patent rights has become a regular business, and several hundred thousand dollars, it is estimated, are paid annually for void patents, many of which are thus fraudulently obtained.

In this collision and interference of patents, the original and meritorious inventor sees his invention, to the perfection of which he has devoted much time and expense, pirated from him, and he must forego the reward which the law was intended to secure to him in the exclusive right it grants; or he must become involved in numerous and expensive lawsuits in distant and various sections of the country, to protect and confirm his rights. If he be wise, he will generally avoid the latter, and submit to the former alternative of injustice, to which the Government, as the law now is, makes itself accessary. The practice is scarcely less reprehensible, of taking out patents for what has been long in public use, and what every one has therefore a right to use. The patentee in such cases being armed with the apparent authority of the Government, having the sanction of its highest officers the seal of State, scours the country, and by threats of prosecution, compels those who are found using the thing patented, to pay the patent price or commutation tribute. This exaction, unjust and iniquitous as it is, is usually submitted to.

The extent of the evils resulting from the unrestrained and promiscuous grants of privileges, may be imagined, when it is considered that there are now issued, since this year commenced, at the rate of more than a thousand a year; a considerable portion of which are doubtless void for want of originality in the inventions patented, either in whole or in some of the parts claimed as new.

A necessary consequence is, that patents even for new and meritorious inventions are so much depreciated in general estimation, that they are of but little value to the patentees, and the object of the patent laws, that of promoting the arts by encouragement, is in a great measure defeated.

To prevent these evils in future is the first and most desirable object of a revision and alteration of the existing laws on this subject. The most obvious, if not the only means of affecting it, appears to be to establish a check upon the granting of patents, allowing them to issue only for such inventions as are in fact new and entitled, by the merit of originality and utility, to be protected by law. The difficulty encountered in effecting this, is in determining what that check shall be; in whom the power to judge of inventions before granting a patent can safely be reposed, and how its exercise can be regulated and guarded, to prevent injustice through mistake of judgment or otherwise, by which honest and meritorious inventors might suffer wrong.

It is obvious that the power must, in the first instance, be exercised by the department charged with this branch of the public service. But as it may not be thought proper to intrust its final exercise to the department, it is deemed advisable to provide for an occasional tribunal to which an appeal may be taken. And as a further security against any possible injustice, it is thought proper to give the applicant, in certain cases, where there may be an adverse party to contest his

an opportunity to have the decision in a court of law.

duty of examination and investigation ary to a first decision at the Patent- is an important one, and will call for ercise and application of much scien- equirement and knowledge of the ex- state of the arts in all their branches, ly in our own, but in other countries. qualifications in the officers charged he duty, will be the more necessary and ble, because the information upon which ction is made at the office, will be ble in the final decision. It becomes ary, then, to give the Patent-office a ganization, and to secure to it a cha- altogether above a mere clerkship. ompetency and efficiency of its officers correspond with their responsibility, ith the nature and importance of the required of them. When the exist- ganization was adopted, the granting ents was a matter of little importance, red with what it now is. The arts in untry were but little understood, and ttle cultivated. Agriculture and com- constituted our principal business. ad few manufactures, except those of a tic character, adapted to ordinary do- wants. Our workshops were in Eu- Enterprise, in this country, ran in channels. The war of 1812 gave it a irection, and a new impulse, by creat- n occasion for workshops of our own. sity became the mother of invention, merican manufactures sprang into exist- as by enchantment. Their rise and ess may be dated from that period; and e rapid advancement in the arts, and a astonishing development of human in- ty, have never taken place in any other or country. This remark will appear rom extravagant to every one who will the trouble to examine the subject. awakening of dormant genius to a prac- and active existence, next to the arous- f the political and patriotic energies of Jnion, was one of the great results of contest.—It opened to the country a era. The nation entered upon a new ence. And since that period, American try and enterprise, guided by American uity and intellect, have achieved what l have taken Europe a century to ac- lish. She has become all at once a facturing, as well as an agricultural ommercial nation. The useful arts have cultivated with a success before unex- ed, and have contributed, in no small e, to the wonderful improvements which spread themselves over our whole coun- Who can predict the results, even in a ears, of that spirit of enterprise which des the Union, when, aided by the Genius of Invention, and propelled onward by powers which she alone can bring into exercise? The very elements are submissive to her will, and all the endless combinations of mechanism are subservient to her purposes. She participates in almost every business and employment of man. Agriculture itself might as well dispense with fertility of soil, as with her aid in its cultivation.

The greatly increasing number of patents granted, affords some indication of the improvements which have been going on in the useful arts from year to year. The average number issued annually, from 1790 to 1800, was but 26; from 1800 to 1810, the average number was 91; from 1810 to 1820, it was 200; and, for the last ten years, the average number has been 535. During the last year, there were issued 776; and there have been granted in the first quarter of the present year 274, being more in three months than were issued in the whole of the first period of ten years. In the 22 years preceding the war of 1812, the average annual number was 73. The first quarter of the present year indicates an aggregate for the year, of 1,096; the amount of the duties on which, will be upwards of 32,000 dollars. The whole number issued at the Patent-office, under the laws of the United States, up to the 31st of March last, is 9,731. This is more than double the number which have been issued either in England or France, during the same period. In England for ten years preceding 1830, the average number of patents granted in one year was 145.

Whoever imagines that, because so many inventions and so many improvements in machinery have been made, there remains little else to be discovered, has but a feeble conception of the infinitude and vastness of mechanical powers, or of the unlimited reach of science. Much as has been discovered, infinitely more remains unrevealed. The ingenuity of man is exploring a region without limits, and delving in a mine whose treasures are exhaustless. "Neither are all the mysteries of nature unfolded, nor the mind tired in the pursuit of them."

The first conceptions of ingenuity, like the first suggestions of science, are theories which require something of experiment and practical exemplification to perfect. Mechanical inventions are at first necessarily crude and incomplete. Time is required to develope their imperfections, and to make the improvements necessary to their adaption to practical uses. Inventors generally obtain patents before they venture upon those experiments which only can test their inventions. They are apprehensive of being forestalled in their discoveries, and see no other means of protecting themselves against piracy and fraud, than by securing patents at once

A remedy for this may be easily had in a provision authorising caveats to be filed in the office, giving security to the right of discovery for a time sufficient for making the necessary experiments, inquiries, and improvements.

Heretofore, aliens not resident in this country have not been admitted to the privileges of our patent laws. But, as American citizens are allowed to take out patents in England and in other countries, a principle of reciprocity would seem to require that foreigners should have similar privileges here, on paying a similar duty or amount of fees that is exacted of our citizens abroad. The fees payable in England, on taking out a patent, amount to 585 dollars. If a patent be taken out for the three kingdoms of England, Ireland, and Scotland, they amount to 1,680 dollars. In France they are 309 dollars; in Spain, 292 dollars; Austria, 208 dollars.

A power in the Commissioner of the Patent-office to reject applications for want of novelty in the invention, it is believed, will have a most beneficial and salutary effect in relieving meritorious inventors, and the community generally, from the serious evils growing out of the granting of patents for every thing indiscriminately, creating interfering claims, encouraging fraudulent speculators in patent rights, deluging the country with worthless monopolies, and laying the foundation for endless litigation.

In nineteen cases out of twenty, probably, the opinion of the Commissioner, accompanied by the information on which his decision is founded, will be acquiesced in. When unsatisfactory, the rights of the applicant will find ample protection in an appeal to a board of examiners, selected for their particular knowledge of the subject-matter of the invention in each case.

By this means, without danger to actual and honest inventors, the number of patents would be somewhat diminished. But there would be more confidence in those which should be granted, and as those which have been heretofore issued, should be daily expiring by their limitation, the community would begin to feel and realise the advantages of such a change. The present law waits till infringements and frauds are consummated—nay, it even aids them; and then it offers an inadequate remedy for the injury, by giving an action for damages. It ought, rather, by refusing to grant interfering patents, to render prosecutions unnecessary. Instead of sanctioning the wrong by granting the privilege to commit it, it should arrest injury and injustice at the threshold, and put an end to litigation before it begins.

Important and interesting as the Patent-office is now considered, it is believed that, under such new organization as is contemplated by the bill presented herewith, it will contribute largely to the great interests of the country, and bear no small part in elevating our national character. American ingenuity has obtained much consideration on the other side of the Atlantic. Even the manufactures of England are not a little indebted to it for some of their most valuable improvements. Her woollen manufactures, especially, have, within a few years, undergone an entire change, by the adoption of American inventions, by which wool has been made as yielding and submissive to the power of machinery as any material whatever. Cotton machinery has also been greatly improved in the hands of our mechanics; and while England receives from us three-fourths of the cotton she uses in raw materials we furnish her also with some of the most valuable improvements in the means of manufacturing it. Indeed, what mechanism or manufacture has, for the last twenty years, been brought across the Atlantic, that has not, on being returned, borne the distinguished marks of the superior ingenuity of American mechanists? Formerly, we borrowed and copied much that was valuable from Europe. Now, Europe is borrowing and copying, with no little advantage, from us; and she must not be too much surprised if she shall soon find a formidable balance against her.

To carry fully into effect the objects which have been had in view, it will be necessary to provide larger and more commodious rooms for models, &c., than those now occupied for that purpose. They are insufficient for the models of machinery and other inventions now deposited there, and the number will be increasing several hundred, perhaps a thousand, every year. A great number, supposed to be about five hundred, from a want of room for them elsewhere, have been stowed away in a dark garret. Those which occupy the rooms designed for them, are crowded together in a manner unfavourable for exhibition or examination. In such a situation, it is impossible to give them any systematic or scientific arrangement. This disorder and confusion must necessarily be increased by the addition of those hereafter furnished, or they must be consigned to the garret, the common receptacle, where, instead of promoting a taste for, and facilitating the study of, the useful arts, they will only afford evidence of the improvidence of the Government. In addition to this, the present building is too much exposed to destruction by fire. The loss of records and drawings, and of the several thousands of interesting and valuable models now preserved there, would be, in a great degree, irrepara-

There is no additional room to be had building they now occupy. The Post- Department, in the same building, d of having any room to spare which is ppropriated to it, requires a consider- xtension of accommodations, from its sed and increasing business. It needs iole building. The only way, therefore, viding the necessary extension of room e accommodation of the Post-office rtment, and the city post-office, and of ling the requisite accommodation for atent-office, is to erect a suitable fire- building for the latter on some one of blic lots. There are ample funds aris- om duties on patents, heretofore paid he Treasury, to the account of clerk n that office, which remain unexpended. tion of that surplus fund, being now 152,000 dollars, may well be appro- d to the construction of a building should be commodious and compara- safe from fire.

ch a building as this branch of the e interests requires, would do honour to Government and the country. The t-office, with such accommodations, ining the records of this age of inven- displaying in its halls and galleries erless models of ingenious and useful anism, and contrivances in almost in- variety, adapted to the mechanic arts, anufactures, to husbandry, to naviga- steam-power, horse-power, water- r, railroad transportation, and, in fine, the common trades and mechanical its of life, as well as to our rapidly plying and magnificent public works, present an object of interest, and tend little to elevate our national character. s been justly remarked that we can go o mechanic shop, into no manufactory y description, upon no farm or planta- or travel a mile on our railroads or r steam-boats, without seeing the evi- of our originality, and witnessing the and effects of our ingenuity and enter- All the inventions and improvements echanism which have done so much to- advancing the useful arts and manufac- should, as far as practicable, be exhi- in one view in the halls of the Patent- Such a display would attract the at- n of the many thousands who annually he capital of the Union from all quarters e country, and all parts of the world. her nation has yet any thing to be com- with it; neither England nor France ver required models to be deposited of ted machinery. Collections of models rawings have sometimes been made by te associations, but they are small in er compared with those we possess. addition to the models of machinery, it is proposed to embrace an exhibition of specimens of useful and elegant fabrics and of works of art, which manufacturers and artificers muy place there for that purpose. It might, too, embrace a cabinet of interesting minerals, which may be received from time to time from the various parts of our widely-extended country, with polished specimens of its beautiful marbles from their different locations, illustrating the geology and many of the natural resources of the country; and, also, a collection of Indian curiosities and antiquities, many of which are now in the possession of one of the departments, boxed up for want of some suitable place for their exhibition.

In short, the halls of the Patent office should present a national museum of the arts, and be a general repository of all the inventions and improvements in machinery and manufactures, of which our country can claim the honour; together with such other objects of interest as might conveniently and properly be placed under the superintendence of the Commissioner. Such an institution, while it would be an object of just pride to every American, would have scarcely less influence in advancing and accelerating the progress of the useful arts and the improvement of our manufactures, than would even the encouragement afforded by granting patents for inventions, or establishing high tariffs of protection.

With these views, the Committee cannot hesitate to recommend an entire re-organisation of the Patent-office, and several material alterations in our law of patents, suiting it to the present condition of the arts and the altered circumstances of the country.

A bill in conformity with our views is herewith submitted.

(The Bill in our next.)

(The Bill in our next.)

THE BRITISH MUSEUM.

We have been much gratified by the perusal of a letter which has been addressed to the Chancellor of the Exchequer, and "privately printed," containing "A Plan for the better Management of the British Museum," by Mr. John Millard. The writer, by way of apology for addressing Mr. Spring Rice on the subject, mentions some things which are very much to the honour of that respected functionary, though not, we suspect, so generally known as they deserve to be.

"Sir,—The public are so deeply indebted to you for the interest you have taken in the affairs of the British Museum, and the anxiety you have shown to extend its utility

not only by your proposal for a "School of Design," for the encouragement of the arts and manufactures, and for the increased facilities of access to the Museum, by giving your sanction to its being opened during the holidays, and the establishment of an evening reading-room—but by the purchase, at your recommendation, of the valuable Egyptian antiquities of the late Mr. Salt,—of a magnificent collection of Dutch etchings,—of a considerable portion of the late Mr. Heber's valuable manuscripts,—of the matchless Durand collection of Etruscan vases,—and the unique Bible of Alcuin and of Charlemagne, that I am induced to believe I cannot address myself to any one more competent to appreciate the plan for the better management of the British Museum, which I have now the honour to submit to your notice."

As there is no individual in the State who could, for these reasons, have been addressed with more propriety on the subject than the Chancellor of the Exchequer, so, on the other hand, is there no person who has a better right to be the addressing party, or a stronger claim to be listened to with attention, than Mr. Millard. It was owing to the representations and remonstrances of this gentleman that the recent Parliamentary inquiry into the state of the Museum was instituted; and it is to him the public will stand principally indebted for whatever benefit may result from it. He not only originated the inquiry, but has, to our knowledge, pursued it for these three years past, at great personal sacrifices both of time and money. For a long period previously to that he had been engaged in preparing a new general index to all the collections of MSS. in this establishment; and he obtained by this means such an insight into the details of its management, as renders him a most competent witness on the subject; and to a perfect acquaintance with all the facts of the case, he adds great shrewdness, and a most sound judgment.

The "Plan" which he proposes for the reformation of the Institution is, after a general review of its history—its excellences and defects—thus presented to the reader:—

"I would propose then, sir, that an Act of Parliament should be passed which should first repeal all acts relating to the British Museum, and then appoint the present Official Trustees (with the exception of the Presidents of the Royal Academy, the Royal Society, the Society of Antiquaries, and the College
of Physicians, who might form a part
proposed new Council), nineteen in n
the responsible or *legal* Trustees of the
property of the Museum, whose duty it
be to watch over and protect the vario
lections, but who should not have any
in the management. The *ten* family
tees, with any others that it might be
after necessary to appoint, to be T
only of the particular property which
represent, their sole duty being to p
the integrity of their respective tru
would also propose that, after the pass
this Act, the services of the elected T
be dispensed with, and that no simila
be created.

"To supply the place of the present
of Management, I beg to submit to
consideration the propriety of appo
a Council, to consist of twenty pers
be *named by the Government*, who shou
of them be eminently distinguished in
the following branches of science and
ing:—1. Geology and Oryctology; 2
neralogy; 3. Conchology; 4. Botan
Entomology; 6. Ornithology; 7. Icthy
8. Amphibia and Reptilia; 9. Mam
10. Comparative Anatomy and P
logy; 11. Egyptian and Indian
quities; 12. Grecian and Roman
ture; 13. Architecture* and School o
sign; 14. British Antiquities; 15.
Gems, and Medals; 16. Pictures,
Maps, and Charts; 17. Ethnography
Arts and Manufactures of Great Brita
Palæography; 20. Bibliography.

"There would, I am persuaded,
difficulty in selecting from the gal
talent which now adorns our country (
the presumed 'dulness' of the En
individuals eminently fitted to giv
advice and assistance in the improvem
the National Museum. Among tho
have devoted their energies to the suc
cultivation of natural science may be
tioned Sir John Herschell, of whose sc
acquirements, and liberal and enlig
views, every Englishman may be justly
nor can I hesitate to add the names
Philip Egerton, Messrs. Airy, Dalton,
thus Gregory, Sedgwick, Greenough,
chison, Henslow, Mac Leay, Grant, V
Bell, Owen, and South; and many
might be readily enumerated. In a
have a Chantrey, a Bailey, the accom
President of the Royal Academy, an
Sheepshanks; and in architecture, a
whose magnificent and unique design

* The attendance of an eminent archite
council would be very desirable, not only
the progress of the new buildings, but in
any alterations it may be necessary to make
present plan, which, it is said, is not exactly
to the wants of the Museum.

New House of Commons, with other beautiful productions of this enlightened artist, deservedly place him at the head of his profession. The field of literature would offer an abundant choice of distinguished authors, and of gentlemen eminently skilled in books and manuscripts; suffice it to mention the names of Mr. Petrie, the Keeper of the Records in the Tower, Sir Harris Nicolas, and Mr. Hallam. The study of Egyptian Antiquities has been ably illustrated, and the National Museum benefited, by the labours and researches of Mr. Wilkinson, and others; and no small praise is due to Mr. Gage, the Director of the Society of Antiquaries, for his perfect acquaintance with the much neglected study of the Antiquities of Britain. It would, I fear, sir, occupy too much of your valuable time to pursue this subject; but I cannot conclude the imperfect list I have hastily sketched without recording the names of Sir John Barrow, whose geographical and ethnographical acquirements are so eminently displayed in his valuable publications; and of Mr. Babbage, whose knowledge of the arts and manufactures, and the best means for their successful improvement, are too well known to need any eulogium from my pen.

"I would further propose, that the individuals forming the new Council should annually elect from among themselves a President, subject to the approval of the Government, and should possess the entire management of the Museum; but should, like the Record Commission, report from time to time to the Executive Government, and be placed under the immediate control of one of the ministers of state, as is almost uniformly the case in foreign museums.

"I would also submit to your consideration the propriety of dividing the Museum into twenty distinct departments, as before enumerated, and of appointing a Director to each of them, who should be *named by the Government*, at the recommendation of the Council. These Directors, together with a Principal Director, to be appointed by his Majesty, also at the recommendation of the Council, should be entitled to a seat at the board, but without a vote.

"The benefits to be derived from such an association of the officers with the Council would be very great; the Council, being all men of high attainments in their respective branches of science and learning, would be competent judges of the deficiencies in the various collections, and would thus be enabled to determine on the expediency of complying with the requests of the Directors of the several departments. Another advantage would accrue; there would be an *equal* division of the money granted by Parliament for the support of the various objects of the Museum; and no one department would be favoured at the expense of another. If it were considered necessary, a Board of Visiters, similar to that attached to the Board of Longitude, might be named by the Government—a measure recommended by Sir Hans Sloane, the founder of the Museum—who might from time to time visit and examine the establishment, report to the Government on the proceedings of the Council, and make any useful suggestions that might occur to them.

"The great defect of the existing constitution of the Museum is, that the present Trustees are an *irresponsible body*—being amenable only to Parliament for the management of the Institution; and unless the tedious process of a Committee of Inquiry be resorted to, no complete information can be obtained as to the state and condition of the Museum, as to its retrograde or forward movements; the annual account presented to Parliament of the receipt and expenditure, and of the number of *visits* and visiters to the Museum, affording no data by which the Executive can form a satisfactory opinion on these matters. It remains only then, Sir, to urge upon your consideration the plan which I have suggested for infusing new life and vigour into the national museum, being fully assured, that every improvement therein, now so anxiously desired by the public, would speedily follow the proposed change in its constitution; but without such an alteration, I fear there is little probability of any permanent good being effected by the present, or any other inquiry that may be instituted on the subject."

Mr. Millard has in this extract urged so well the advantages of the "Plan" he proposes, that we need only say that it has our entire approbation and best wishes for its speedy adoption.

RAISING THE STATUE OF NAPOLEON.

At a meeting of the Institute of British Architects, held on the 3rd of June, Mr. T. L. Donaldson, Honorary Secretary, explained the means lately employed for placing the statue of Napoleon upon the Colonne Vendome, Paris. This operation was one of considerable difficulty. It is true that, as a statue had previously been placed on this column, and had been removed, M. Lepère, the architect charged with the task of erecting the present statue, had precedents to resort to; but, unfortunately, they were such as were of no use to him. When the first statue was placed in its elevated situation, the workmen availed themselves of the scaffolding already fixed firmly in the ground for erecting the column, and, of course, found scarcely any difficulty; and the apparatus

which was used for taking down the statue was inapplicable to the raising another in its place. M. Lepère was therefore obliged to contrive a plan for himself, which he adopted with great success, and which has the rare merit of being extremely simple, at the same time that it displays an admirable combination of theoretical knowledge with practical experience.

This plan consisted of a scaffolding, on which was placed the crab destined to raise the statue, and which had for its basis the front wall of the column, and for its point of resistance the whole weight of the cupola, which was nearly 27,000 kilogrammes. The weight of the statue, crab, cable, &c., was about 7000 kilogrammes; so that an immense power was given to the long arm of the lever. The details could not be understood without cuts, but we shall probably give them, with these, in a future number.

The statue, which was modelled by M. Seure, sculptor, was cast at Roule, by M. Crozatier. Its height is eleven feet French (about twelve feet English) from the top of the hat to the plinth, and the plinth is nine inches, French, more. The statue is fixed on the column by strong iron pins, which are soldered deeply into bronzes, placed for that purpose on the capital of the column. —*Architectural Magazine for July.*

NOTES AND NOTICES.

Sugar from Urine.—It has long been ascertained that the urine of persons afflicted with diabetes, contained pure sugar. The following account of a loaf of sugar from such a source shows that the manufacture has increased. Indeed the sugar would, for cheapness of the *raw material*, rival that either from the best cane or Indian corn; but, unfortunately, diabetes is a disease of rare occurrence, and, with the exception of a few local instances, we are convinced that the supply from this source may be considered as absolutely nothing. "M. Peligot has presented to the Societie Philomathique, a loaf of sugar which he had extracted from the urine of a patient now in the hospital of La Charite, afflicted with the saccharine diabetes. This man voids about twenty quarts of urine a day, of which five parts in every hundred is sugar."

German Mechanics' Magazine.—In the "Intelligenz-blatt," or Intellige ce-leaf of the Jenaische Litteratur-Zeitung, for December, 1835, is an advertisement for the "Magazin der neuesten Erfindungen, Entdeckungen, und Verbesserungen, herausgegeben von Dr. F. E. Thieme," &c. &c., i. e. "The Magazine of the newest Inventions, Discoveries, and Improvements of the English, French, Italians, Americans, and Germans, in all kinds of useful arts; for Manufacturers, Artists, Mechanics, and Agriculturists. Edited by Dr. Frederick Edward Thieme. New Series, vol. ii. No. 12, with 20 engravings, price 8 groschen." Then comes the following notice:—"Unweariedly anxious for the improvement of our periodical, we have made an arrangement with the proprietors of the well-known *London Mechanics' Magazine* (which incontestably takes the first place among all periodicals that treat of new inventions, improvements, &c.,) to send over to us casts (Abklatsche) of their engravings, together with early sheets of the letter-press, so that we are now able to present our readers with the most interesting articles in the *Mechanics' Magazine*—in the same manner as we have been in the habit of doing for several years—almost at the same time as they appear in the latter, and accompanied by the original English engravings. We are convinced that our readers will agree wi h us on the great advantage of this arrangement for our periodical."

Wood-Polishing.—The Persians have introduced an entirely new mode of polishing, which is to wood precisely what plating is to metal. Water may be spilled on it without staining, and it resists scratching as well as marble. The receipt is as follows:—To one pint of spirits of wine, add half an ounce of gum shellack, half an ounce of gum lack, half an ounce of gum sundrick; placing it over a gentle hea', frequently agitating it until the gums are dissolved, when it is fit for use. Make a roller of list, put a little of the polish upon it, and cover that with a soft linen rag, which must be slightly touched with cold-drawn linseed-oil. Rub the wood in a circular direction, not covering too large a space at a time, till the pores of the wood are sufficiently filled up. After this, rub in the same manner spirits of wine, with a small portion of the polish added to it, and a most brilliant polish will be produced. If the outside has been previously polished with wax, it will be necessary to clear it off with glass paper.—*American Railroad Journal.*

The Count de Laplace.—A monument has been raised to this great man at Beaumont, and placed on the site of the house where he was born. It is a building erected for the purposes of a primary school, and a hall for the mayoralty. Two tablets of marble are inserted in the front of the building: on one it is recorded, that the corporation of Beaumont had erected this edifice to the memory of Laplace, who was born at Beaumont, the 22d of March, 1749; and died at Paris, the 5th of March, 1827. On the other is inscribed the following:—

"Sous un modeste toit, ici naquit Laplace,
Lui qui sut de Newton agrandir le compas;
Et, s'ouvrant un sillon dans les champs de l'espace,
Y fit encore un nouveau pas."—*Athenæum.*

Communications received from Mr. Jones—Mr. Waldron—P. Q. R.—An Inventor—Archimedes—F. H.

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C. E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

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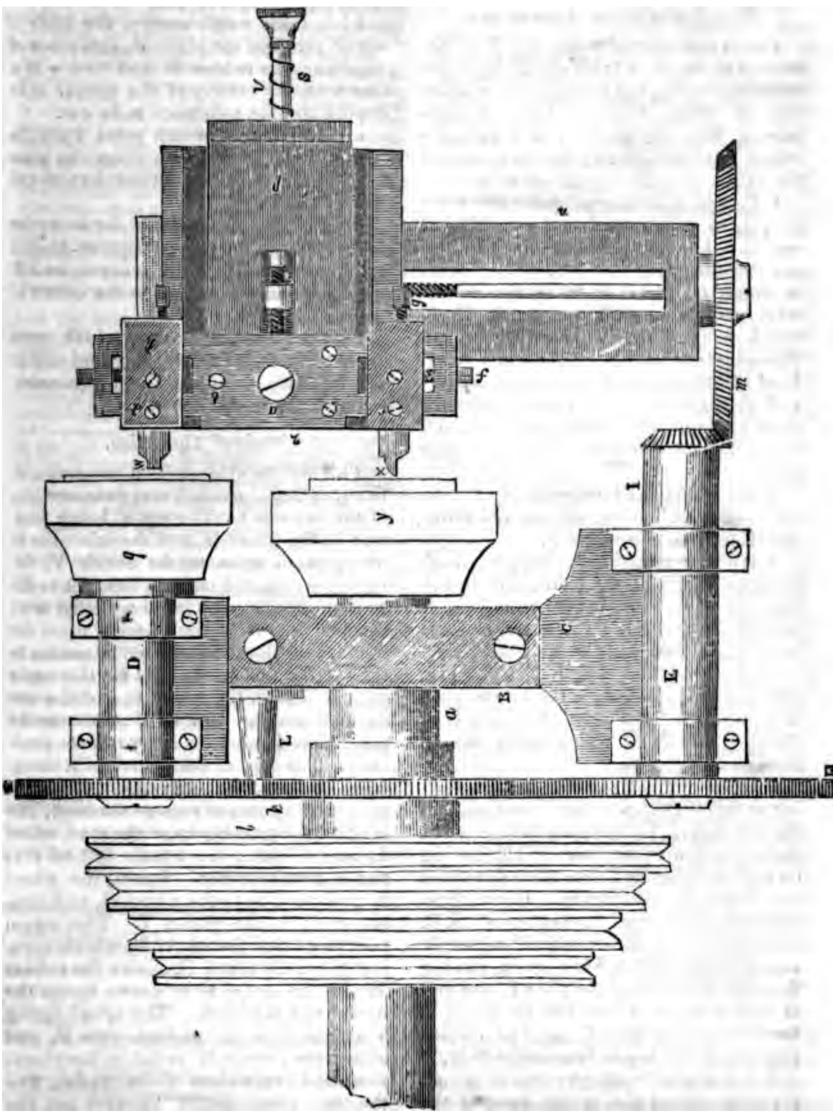
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 674. SATURDAY, JULY 9, 1836. Price 3d.

HEINEKEN'S MEDAL-CUTTING ENGINE.

Fig. 1.



MEDAL-CUTTING ENGINE.

Sir,—I herewith forward drawings and description of an apparatus which I have contrived for forming medallions in the lathe, which I shall be gratified by your inserting in your valuable Journal.

I am, respectfully yours,

N. S. HEINEKEN.

Sidmouth, Devon, May 30, 1836.

Description of the Engravings.

Fig. 1 is a ground plan; fig. 2, a section; and fig. 3, a front elevation of the machine. *a a a*, the mandril of the lathe, with a chuck screwed upon it containing the substance upon which the medal is to be formed; B, the poppet of the lathe.

C C, two "carriages" screwed to the poppet, in which revolve the spindles D and E. The spindle D has fixed to it at one end the wheel F, which is $2\frac{8}{10}$ inches in diameter, and has 80 teeth; on the other end is screwed the chuck G, in which is fixed the medal to be copied. The spindle E has also at one end a wheel H of 120 teeth, and $4\frac{1}{10}$ inches diameter; and at the other end a wheel I, bevelled at an angle of 45°, having 28 teeth, and being $1\frac{1}{10}$ inch diameter at the largest part.

K is a wheel fixed to the mandril of the lathe, of *exactly* the same size and number of teeth as the wheel F.

L is a stud affixed to the poppet, which carries a wheel of 40 teeth, and is $1\frac{4}{10}$ inch diameter. This wheel runs in geer with the two wheels F and K, and underneath them, as shown in the front view.

M is a bevelled wheel of 108 teeth, and $2\frac{7}{10}$ inch diameter at the largest part. This wheel is fixed upon the screw O of the slide rest N N, which screw has 50 threads in the inch.

P is a dovetailed plate—as usual, sliding at right angles to the foundation of the rest N N. To this plate is screwed at right angles another plate Q Q Q, having its two ends formed into male dovetails, as shown in the section. Upon these dovetails slide the "receptacles" R R, containing the small "rubber" wheel W and the chisel χ. S S is a screw, passing through the centre of the plate P, one end of which screw is received by a stud T, fixed in the plate of the rest, which slides upon the top or foundation N N.

V is a *slight* brass-wire spiral spring, pressing against the milled head of the screw S S and the sliding-plate P, the consequence of which is, that the rubber-wheel and tool, attached to this plate by the plate Q Q, are kept in contact, the one with the medal, and the other with the substance to be cut; and the pressure may be increased or diminished by turning the milled head of the screw S S.

a, the screw by which the plate Q Q is affixed to the sliding-plate P.

b b b, three small screws, the ends of which press on the plate P, and allow of adjusting the rubber W and tool χ in a line with the centres of the medal to be copied and the substance to be cut.

c c, two screws, which press upon the tool χ, and, as this rests upon the plate Q Q, fasten at the same time the tool and its receptacle.

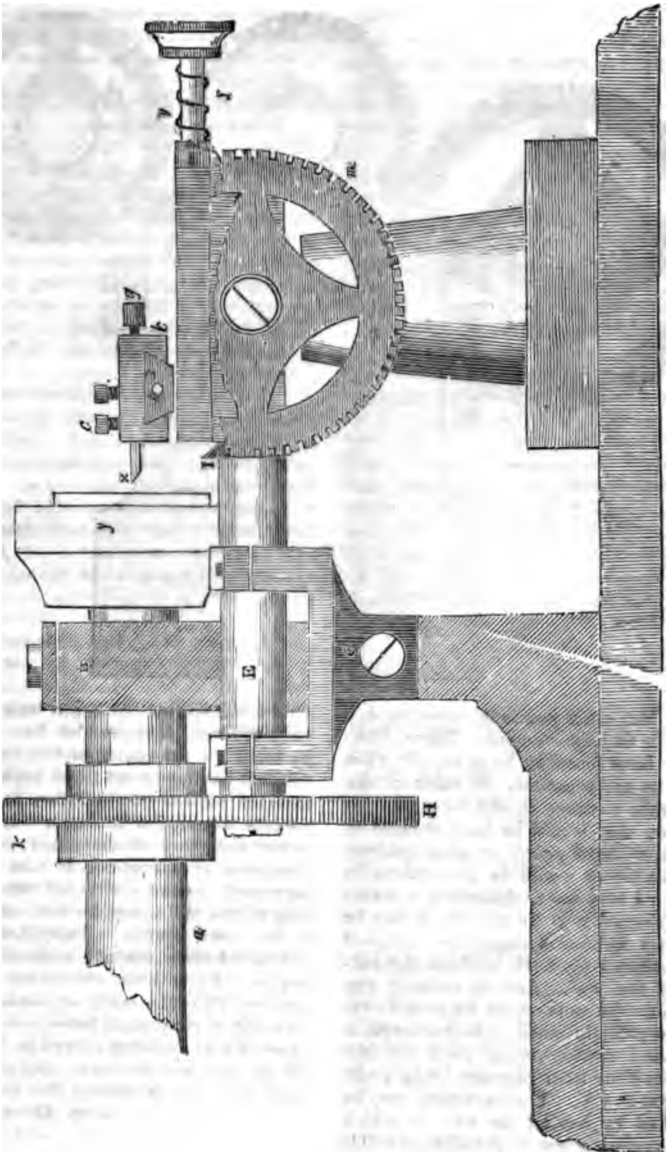
d d are two similar screws for fixing the rubber-wheel. *e f*, two square-headed screws, which adjust the receptacles R R with the tool and rubber to the centre of the medal and work.

g h, two similar screws, which press against the ends of the tool χ and rubber W, in order to adjust them *accurately* to touch the medal and work.

Mode of Operation.

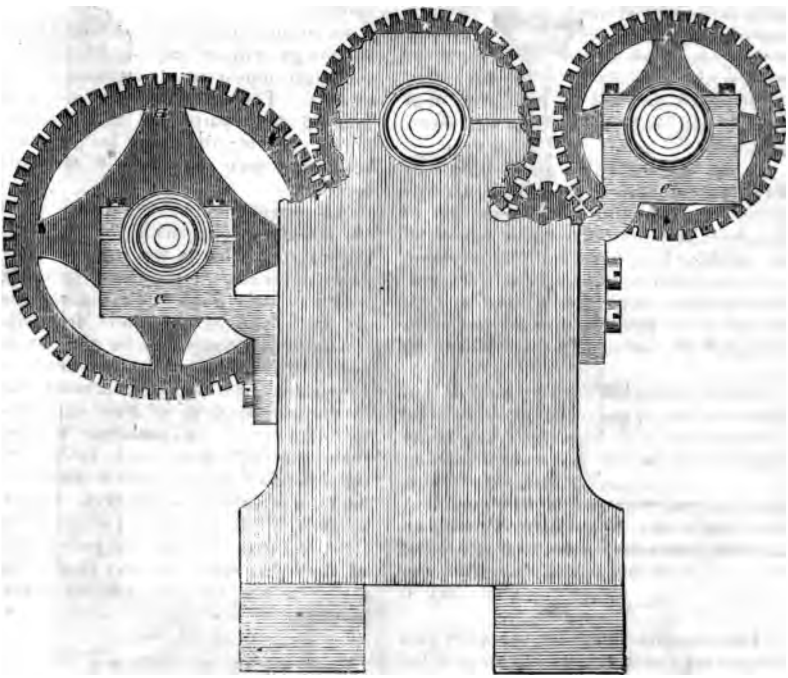
This will be evident from inspection of the drawings, (which, I may state, are $\frac{1}{7}$ths of the full size). The medal being fixed true in the chuck G, and the substance to be operated upon on the chuck Y, the rubber-wheel and tool are brought to the centres of their work, and adjusted so as to touch it. Now the wheel K upon the mandril of the lathe *a a* gives motion to the small wheel on the stud L; this again puts in motion the wheel F, and the medal on G and the work on Y revolve in the same direction, and in every respect similarly. The copy of the medal will, therefore, be like the original. But if it should be desired to *reverse* the copy, this is effected by taking away the stud-wheel L, and allowing the wheels K and F to run in geer together. Again, the wheel K gives motion to the wheel H, and consequently to the pinion T. This again puts in motion the wheel M, which, turning round the screw O, causes the rubber W and the tool χ to be drawn across the medal and the work. The spiral spring V acting upon the sliding-plate P, and allows the rubber W to follow the elevations and depressions of the medal, and the tool, consequently, to carve out the

Fig. 2.



same. The rubber-wheel is barely one-tenth of an inch diameter, and is of iron, the medals being of copper. When the subjects to be copied are on silver or wood, I should use wheels of brass, mother-of-pearl, or ivory. Of course, the *smaller* and *thinner* the rubber-wheels can be made, the *sharper* will be the

Fig. 3.



copy. But could *points* be substituted, it would be an improvement. These, however, I have found to be so rapidly worn away, as to be useless. If some of the fine Berlin castings in iron were used as patterns, they would be little injured by employing *hard points* or *steel* rubbers, and the copies would be proportionably better. I may state, that when a medal in high relief is to be copied, it may be necessary to have a stop-screw attached to the sliding-plate P, to limit the cutting of the tool. And in forming any medallion the work must be passed over and over again until it is perfected, a slow-hand motion being used for the lathe, and the least pressure being given by the spring V. The operation may be expedited by having the nut, in which the traversing-screw of the slide-rest (O) works, slit so that the screw might be at once relieved, and the tool, &c. set back by hand to the centre of the work, instead of having to set them back by the reversed motion of the lathe, &c. The medals would also be better executed if either the screw O were finer, or if the diameters of the wheels H and M were increased, as the strokes left by the cutting of the tool would be then so fine as to be imperceptible. This, however, I did not foresee when I constructed the engine. By a little alteration, I doubt not but that this same apparatus might be made to copy small busts, ornamented vases, &c. they being affixed to the spindle D, and the slide-rest, &c. turned at right angles to its present position.

N. S. Heineken.

SIDERIAL TIME MOST IMPORTANT FOR ASCERTAINING A SHIP'S PLACE.

Sir,—The great distance of the fixed stars renders a parallax of the earth's *orbit imperceptible. The* parallelism of the earth's axis is constant, without any sensible variation. Hence an *exact rotation of the earth* is performed between

culmination and culmination of a fixed star.

The acceleration or retardation of the earth in its annual orbit, as the distance from the sun is diminished or increased, is no preventive to the equableness of the astro-terrestrial period, the unvarying duration whereof has the confirmation of nightly and daily chronometrical ascertainment.

As the diurnal equation of time has, therefore, no relation to the siderial revolution; neither also is the recession of the equinoxes referable to any motion of the earth or fixed stars, for this recession must be gradual throughout the year. But we have concluded against any reservation, ecliptical or other, in the absoluteness of the earth's parallelism in rotation on its axis.

Yet as the fact of the recession is undisputed, its proper origin remains to be considered. And here there can be no dilemma, as the only inference remaining is, that the position of the sun itself must alter in the requisite lateral quantity; that besides that luminary's verticity on its axis, the solar centre moves around the centre of the system (near the exterior of the orb of light) in about 25,920 of our years.

This revolution may be necessary as a counterbalance to the vacillation that the planets, from the changes in their situations, might occasion to the sun; which, though possessing gravity (or intensity of progress through heaven's firmament) vastly superior to an equipoise of all the worlds which circumvolve it in their courses, would else, or less or more, according to the planet's eloinations or approximations, be correspondingly disturbed (unless they for an instant neutralised their influences on the central mass, in opposition checking each other.

Regularity is so conspicuous throughout the dependent parts, that the ascription of a perfect motion to the governing primary of the system, instead of a perpetually shifting agitation, may require small apology, especially as the analogy of gravity and projectile motion concurs with observations in affording ground for the probability of its deduction.

However, this hypothesis of a planetary orbit to the sun is not essential to the main proposition, as our globe's relation to the fixed stars is independent of ecliptical mutation; for it is as impossible for the earth to have proper motions on two axes, as for a single particle to travel simultaneously in two great circles of a sphere.

In constructing a siderial time-keeper, advantage will, of course, be taken of the latest improvements by chronometer-makers. The division of its dial-plate into 36 great parts (10° each) may be found eligible; the index to perform a revolution once during each terrestrial rotation.

An observation of what stars are *in the meridian* being made instantly with ascertaining what is the position of the index in its circuit, the vessel (provided with a celestial globe or planisphere) may set sail; and its departure from that longitude is detected to be east, by the *apparent slowness* of the time-keeper in comparison with the stars' advance—and by the *seeming delay* of stars coming to meridian after the *port-time* assigned them, the ship's departure is to the west; the difference of longitude in either case being equivalent, in degrees, minutes, seconds, thirds, &c. of the parallel of latitude, to the arc between the port-position of the index when the stars now on this meridian are on that, and its present pointing.

I am, Sir,

Yours most respectfully and obliged,

WM. F. G. WALDRON.

18, Store-street, St. Giles-in-the-Fields.

EFFECTIVE POWER OF LOCOMOTIVE-ENGINES ON LEVELS AND INCLINED PLANES.

Question put to Mr. Robert Stephenson, C. E., by the Committee on the London and Brighton Railway; and Mr. Stephenson's Answer.

QUESTION.

Supposing that for a long distance there is a certain strain which may be represented by any figure or letter, and that that is broken on another line by a series of ascents and descents; supposing that the total amount of strain in both instances be the same, what is the difference of effect upon the engine?

ANSWER.

In order that the following answer may be fully comprehended, it is necessary to premise, that, by the terms of the question, it would appear that it is meant to determine the difference of effect of locomotive power upon two series of planes, from a point A to

which was used for taking down the statue was inapplicable to the raising another in its place. M. Lepère was therefore obliged to contrive a plan for himself, which he adopted with great success, and which has the rare merit of being extremely simple, at the same time that it displays an admirable combination of theoretical knowledge with practical experience.

This plan consisted of a scaffolding, on which was placed the crab destined to raise the statue, and which had for its basis the front wall of the column, and for its point of resistance the whole weight of the cupola, which was nearly 27,000 kilogrammes. The weight of the statue, crab, cable, &c., was about 7000 kilogrammes; so that an immense power was given to the long arm of the lever. The details could not be understood without cuts, but we shall probably give them, with these, in a future number.

The statue, which was modelled by M. Seure, sculptor, was cast at Roule, by M. Crozatier. Its height is eleven feet French (about twelve feet English) from the top of the hat to the plinth, and the plinth is nine inches, French, more. The statue is fixed on the column by strong iron pins, which are soldered deeply into bronzes, placed for that purpose on the capital of the column. —*Architectural Magazine for July.*

NOTES AND NOTICES.

Sugar from Urine.—It has long been ascertained that the urine of persons afflicted with diabetes, contained pure sugar. The following account of a loaf of sugar from such a source shows that the manufacture has increased. Indeed the sugar would, for cheapness of the *raw material*, rival that either from the best cane or Indian corn; but, unfortunately, diabetes is a disease of rare occurrence, and, with the exception of a few local instances, we are convinced that the supply from this source may be considered as absolutely nothing. "M. Peligot has presented to the Societie Philomathique, a loaf of sugar which he had extracted from the urine of a patient now in the hospital of La Charite, afflicted with the saccharine diabetes. This man voids about twenty quarts of urine a day, of which five parts in every hundred is sugar."

German Mechanics' Magazine.—In the "Intelligenz-blatt," or Intelligence-leaf of the Jenaische Litteratur-Zeitung, for December, 1835, is an advertisement for the "Magazin der neuesten Erfindungen, Entdeckungen, und Verbesserungen, herausgegeben von Dr. F. E. Thieme," &c. &c., i. e. "The Magazine of the newest Inventions, Discoveries, and Improvements of the English, French, Italians, Americans, and Germans, in all kinds of useful arts; for Manufacturers, Artists, Mechanics, and Agriculturists. Edited by Dr. Frederick Edward Thieme. New Series, vol. ii. No. 12, with 20 engravings, price 8 groschen." Then comes the following notice:—"Unweariedly anxious for the improvement of our periodical, we have made an arrangement with the proprietors of the well-known *London Mechanics' Magazine* (which incontestably takes the first place among all periodicals that treat of new inventions, improvements, &c.,) to send over to us casts (Abklatsche) of their engravings, together with early sheets of the letter-press, so that we are now able to present our readers with the most interesting articles in the *Mechanics' Magazine*—in the same manner as we have been in the habit of doing for several years—almost at the same time as they appear in the latter, and accompanied by the original English engravings. We are convinced that our readers will agree with us on the great advantage of this arrangement for our periodical."

Wood-Polishing.—The Persians have introduced an entirely new mode of polishing, which is to wood precisely what plating is to metal. Water may be spilled on it without staining, and it resists scratching as well as marble. The receipt is as follows:—To one pint of spirits of wine, add half an ounce of gum shellack, half an ounce of gum lack, half an ounce of gum sundrick; placing it over a gentle heat, frequently agitating it until the gums are dissolved, when it is fit for use. Make a roller of list, put a little of the polish upon it, and cover that with a soft linen rag, which must be slightly touched with cold-drawn linseed-oil. Rub the wood in a circular direction, not covering too large a space at a time, till the pores of the wood are sufficiently filled up. After this, rub in the same manner spirits of wine, with a small portion of the polish added to it, and a most brilliant polish will be produced. If the outside has been previously polished with wax, it will be necessary to clear it off with glass paper.—*American Railroad Journal.*

The Count de Laplace.—A monument has been raised to this great man at Beaumont, and placed on the site of the house where he was born. It is a building erected for the purposes of a primary school, and a hall for the mayoralty. Two tablets of marble are inserted in the front of the building: on one it is recorded, that the corporation of Beaumont had erected this edifice to the memory of Laplace, who was born at Beaumont, the 221 of March, 1749; and died at Paris, the 5th of March, 1827. On the other is inscribed the following:—

"Sous un modeste toit, ici naquit Laplace,
Lui qui sut de Newton agrandir le compas;
Et, s'ouvrant un sillon dans les champs de l'espace,
Y fit encore un nouveau pas."—*Athenæum.*

Communications received from Mr. Jones—Mr. Waldron—P. Q. R.—An Inventor—Archimedes—F. H.

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C. E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

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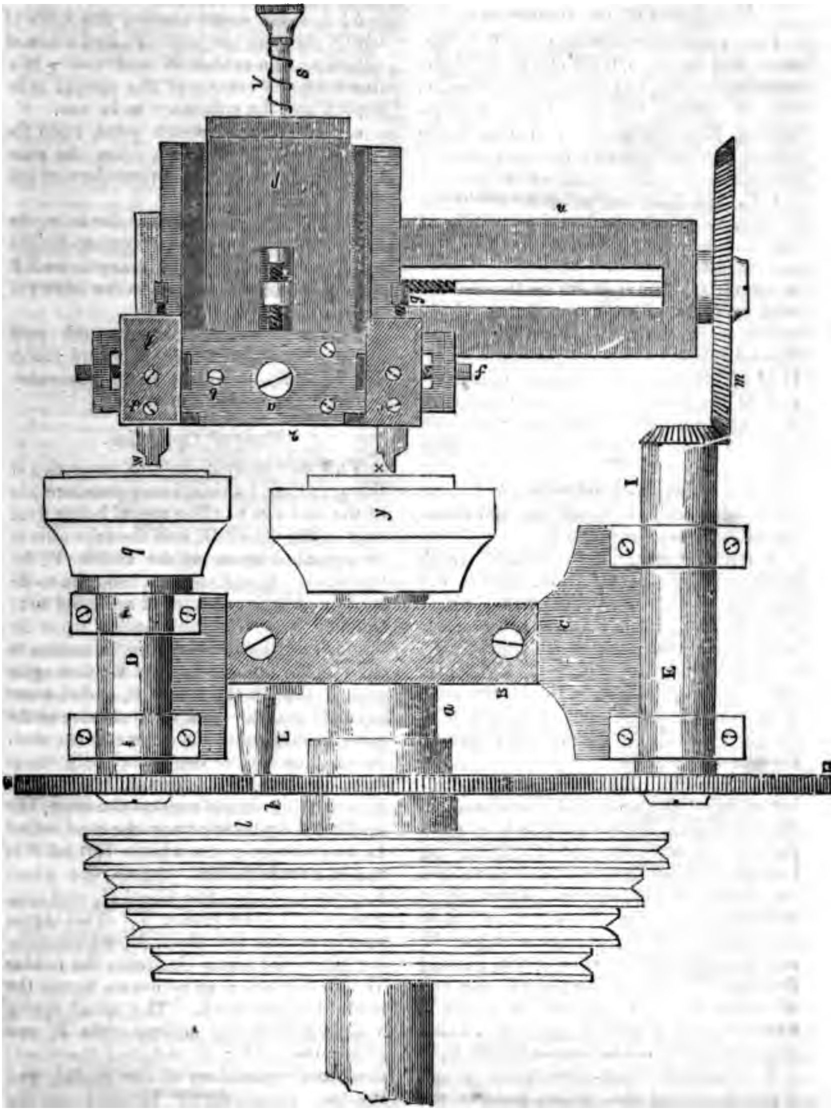
HEINEKEN'S MEDAL-CUTTING ENGINE.

Fig. 1.



the Commissioner of said office, and shall be recorded, together with the descriptions, specification, and drawings, in the said office, in books to be kept for that purpose. Every such patent shall contain a short description of the invention or discovery, and in its terms grant to the applicant or applicants, his or their heirs, administrators, executors, or assigns, for a term not exceeding fourteen years, the full and exclusive right and liberty of using, and vending to others to be used, the said invention or discovery, referring to the specifications for particulars thereof, a copy of which shall be annexed to the patent, specifying what the patentee claims as his invention or discovery.

Sec. 6. And be it further enacted, That any person or persons having discovered or invented any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement on any art, machine, manufacture, or composition of matter, not known or used by others before his or their discovery or invention thereof, and not, at the time of his application for a patent, in public use or on sale, with his consent or allowance as the inventor or discoverer; and shall desire to obtain an exclusive property therein, may make application in writing to the Commissioner of Patents, expressing such desire, and the Commissioner, on due proceedings had, may grant a patent therefore. But before any inventor shall receive a patent for any such new invention or discovery, he shall deliver a written description of his invention or discovery, and of the manner and process of making, constructing, using, and compounding the same, in such full, clear, and exact terms, avoiding unnecessary prolixity, as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound, and use the same; and in case of any machine, he shall fully explain the principle, and the several modes in which he has contemplated the application of that principle, or character by which it may be distinguished from other inventions; and shall particularly specify and point out the part, improvement, or combination, which he claims as his own invention or discovery. He shall, furthermore, accompany the whole with a drawing, or drawings, and written references, where the nature of the case admits of drawings, or with specimens of ingredients, and of the composition of matter, sufficient in quantity for the purpose of experiment, where the invention or discovery is of a composition of matter; which descriptions and drawings, signed by the inventor, and tested by two witnesses, shall be filed in the Patent-office; and he shall, moreover, furnish a model of his machine, in all cases which admit of a representation by model, of a convenient size to exhibit advantageously its several parts. The applicant shall also make oath or affirmation that he does verily believe that he is the original inventor or discoverer of the art, machine, composition, or improvement, for which he solicits a patent, and that he does not know or believe that the same was ever before known or used; which oath or affirmation may be made before any person authorised by law to administer oaths.

Sec. 7. And be it further enacted, That, on the filing of any such application, description, and specification, and the payment of the duty hereinafter provided, the Commissioner shall make, or cause to be made, an examination of the alleged new invention or discovery; and if, on any such examination, it shall not appear to the Commissioner that the same had been known and used prior to such alleged discovery thereof by the applicant, or had been in public use, or on sale, with his consent or allowance prior to the application, if he shall deem it to be sufficiently useful and important, it shall be his duty to issue a patent therefor. But whenever, on such examination, it shall appear to the Commissioner that the applicant was not the original inventor or discoverer thereof, or that any part of that which is claimed as new had before been known and used as aforesaid, or that the description is defective and insufficient, he shall notify the applicant thereof, giving him, briefly, such information as may be useful in judging of the propriety of renewing his application, or of altering his specification to embrace only that part of the invention or discovery which is new. In every such case, if the applicant shall elect to withdraw his application, he shall be entitled to receive back —— dollars, part of the duty required by this act, on filing a notice in writing of such election in the Patent-office, a copy of which, certified by the Commissioner, shall be a sufficient warrant to the Treasurer for paying back to the applicant the said sum of —— dollars. But if the applicant in such case shall persist in his claim for a patent, with or without any alteration of his specification, he shall be required to make oath or affirmation anew, in manner as aforesaid. And if the specification and claim shall not have been so modified as, in the opinion of the Commissioner, shall entitle the applicant to a patent, he may, on appeal, and upon request in writing, have the decision of a board of examiners, to be composed of three disinterested persons, who shall be appointed for that purpose by the Secretary of State, and to be selected for their knowledge and skill in the particular art, manufacture, or branch of science to which the alleged invention appertains; who shall be furnished with a certificate in writing,

of the opinion and decision of the Commissioner, stating the particular grounds of his objection, and the part or parts of the invention which he considers as not entitled to be patented. And the said board shall give reasonable notice to the applicant, as well as to the Commissioner, of the time and place of their meeting, they may have an opportunity of furnishing them with such facts and evidence as they may deem necessary to a just decision; and it shall be the duty of the Commissioner to furnish the board of examiners with such information as he may possess relative to the matter under their consideration. And on an examination and consideration of the matter by such board, it shall be in their power, or of a majority of them, to reverse the decision of the Commissioner, either in whole or in part; and their opinion being certified to the Commissioner, he shall be governed thereby, in the further proceedings to be had on such application; Provided, however, That before a board shall be instituted in any such case, the applicant shall pay to the Commissioner the sum of —— dollars, which shall be in full compensation to the persons who may be so appointed, for their examination and certificate as aforesaid.

Sec. 8. And be it further enacted, That whenever an application shall be made for a patent, which, in the opinion of the Commissioner, would interfere with any other patent for which an application may be pending, or with any unexpired patent which shall have been granted, it shall be the duty of the Commissioner to give notice thereof to such applicants, or patentees, as the case may be; and if either shall be dissatisfied with the decision of the Commissioner on the question of priority or right of invention, he may appeal from such decision, on the like terms and conditions as are provided in the preceding section of this act: and the like proceedings shall be had to determine which, or whether either of the applicants is entitled to receive a patent as prayed for.

Sec. 9. And be it further enacted, That before any application for a patent shall be considered by the Commissioner as aforesaid, the applicant shall pay into the Treasury of the United States, or into the Patent-office, or into any of the deposit banks, to the credit of the Treasury, if he be a citizen of the United States, or an alien, and shall have been resident in the United States for one year next preceding, and shall have made oath of his intention to become a citizen thereof, the sum of forty dollars: if a subject of the King of Great Britain, the sum of five hundred dollars; and all other persons the sum of three hundred dollars; for which payment duplicate receipts shall be taken, one of which to be filed in the office of the Treasurer. And the monies received into the Treasury under this act shall constitute a fund for the payment of the salaries of the officers and clerks, herein provided for, and all other expenses of the Patent-office, and to be called the Patent Fund.

Sec. 10. And be it further enacted, That where any person hath made, or shall have made, any new invention, discovery, or improvement, on account of which a patent might by virtue of this act be granted, and such person shall die before any patent shall be granted therefor, the right of applying for and obtaining such patent shall devolve on the executor or administrator of such person, in trust for the heirs at law of the deceased, in case he shall have died intestate; but if otherwise, then in trust for his devisees, in as full and ample manner, and under the same conditions, limitations, and restrictions, as the same was held, or might have been claimed or enjoyed by such person in his or her lifetime; and when application for a patent shall be made by such legal representatives, the oath or affirmation provided in the third section of the beforementioned act, shall be so varied as to be applicable to them.

Sec. 11. And be it further enacted, That every patent issued in pursuance of this act shall be assignable in law, either as to the whole interest, or any undivided part thereof, by any instrument in writing; which assignment shall be recorded in the Patent-office within three months from the execution thereof, for which the assignee shall pay the Commissioner the sum of —— dollars.

Sec. 12. And be it further enacted, That any citizen of the United States, or alien, who shall have been resident in the United States one year next preceding, and shall have made oath of his intention to become, a caveat setting forth the design and purpose thereof, and its principal and distinguishing characteristics, and praying protection of his right, till he shall have matured his invention; which caveat shall be filed in the confidential archives of the office, and preserved in secrecy. And if application shall be made by any other person within one year from the time of filing such caveat, for a patent of any invention with which it may in any respect interfere, it shall be the duty of the Commissioner to give notice to the person filing the caveat, of such application and of such supposed interference, who shall, within two months after receiving the notice, if he would avail himself of the benefit of his caveat, file his description, specifications, drawings, and model; and if, in the opinion of the Commissioner, the specifications of claim interfere with each other, like proceedings may be had in all respects, as are in this act provided in the case of interfering appli-

cations: Provided, however, That no opinion or decision of any board of examiners, under the provisions of this act, shall preclude any person interested in favour of or against the validity of any patent which has been or may hereafter be granted, from a citizen thereof, who shall have invented any new art, machine, or improvement thereof, and shall desire further time to mature the same, may file in the Patent-office the right to contest the same in any judicial court, having jurisdiction of the subject-matter.

Sec. 13. And be it further enacted, That whenever any patent which has heretofore been granted, or which shall hereafter be granted, shall be inoperative or invalid, by reason of a defective or insufficient description or specification, or by reason of the patentee claiming in his specification as his own invention, more than he had or shall have a right to claim as new; if the error has, or shall have arisen by inadvertency, accident, or mistake, and without any fraudulent or deceptive intention, it shall be lawful for the Commissioner, upon the surrender to him of such patent, and the payment of a further duty of fifteen dollars to cause a new patent to be issued to the said inventor, for the same invention, for the residue of the period then unexpired for which the original patent was granted, in accordance with the patentee's corrected description and specification. And in case of his death, or any assignment made by him of the original patent, a similar right shall vest in his executors, administrators, or assignees. And the patent, so re-issued, together with the corrected description and specification, shall have the same effect and operation in law, on the trial of all actions relative to the violation of such invention, as though the same had been originally filed in such corrected form, before the serving out of the original patent. And whenever the original patentee shall be desirous of adding the description and specification of any new improvement of the original invention or discovery which shall have been invented or discovered by him subsequent to the date of his patent, he may, like proceedings being had in all respects, as in the case of original applications, and on the payment of fifteen dollars, as hereinbefore provided, have the same annexed to the original description and specification; and the Commissioner shall certify, on the margin of such annexed description and specification, the time of its being annexed and recorded; and the same shall thereafter stand on the same footing to all intents and purposes as though it had been embraced in the original description and specification.

Sec. 14. And be it further enacted, That whenever in any action for damages for using or selling the thing whereof the exclusive right is secured by any patent heretofore granted, or by any patent which may hereafter be granted, a verdict shall be rendered for the plaintiff in such action, it shall be in the power of the court to render judgment for any sum above the amount found by such verdict as the actual damages sustained by the plaintiff, not exceeding three times the amount thereof, according to the circumstances of the case; and such damages may be recovered by action on the case, in any court of competent jurisdiction.

Sec. 15. And be it further enacted, That the defendant in any such action shall be permitted to plead the general issue, and to give this act and any special matter in evidence of which notice in writing may have been given to the plaintiff or his attorney, thirty days before trial, tending to prove that the description and specification filed by the plaintiff does not contain the whole truth relative to his invention, or discovery, or that it contains more than is necessary to produce the described effect; which concealment or addition shall fully appear to have been made for the purpose of deceiving the public: or that the thing patented was not originally discovered by the patentee, or had been in use, or had been described in some public work anterior to the supposed discovery thereof by the patentee, or had been in public use or sold with the consent and allowance of the patentee before his application for a patent; or that he had surreptitiously or unjustly obtained a patent for that which was, in fact, invented or discovered by another; or that the patentee, if an alien at the time the patent was granted, had failed and neglected, for the space of eighteen months from the date of the patent, to put in operation and use in the United States, and put on sale to the citizens thereof, on reasonable terms, the invention or discovery for which the patent issued; or in case the same, for any period of eighteen months after it shall have been put in operation and use, shall cease to be so used or put on sale; in either of which cases judgment shall be rendered for the defendant with costs; provided, however, that whenever the plaintiff shall fail to sustain his action on the ground that, in his specification of claim is embraced more than that of which he was the first inventor, if it shall appear that the defendant had used or violated any part of the invention justly and truly specified and claimed as new; it shall be in the power of the court to adjudge and award us to costs as may appear to be just and equitable.

Sec. 16. And be it further enacted, That whenever there shall be two interfering patents, or whenever a patent on application shall have been refused on an adverse decision of a board of examiners on the ground

that the patent applied for would interfere with an unexpired patent previously granted, any person interested in any such patent, either by assignment or otherwise, in the one case, and any such applicant in the other case, may have remedy by bill in equity; and the court having cognizance thereof, on notice to adverse parties and other due proceedings had, may adjudge and declare either of the patents void in the whole or in part, and may also adjudge that such applicant is entitled, according to the principles and provisions of this act, to have and receive a patent for his invention as specified in his claim, or for any part thereof, as the fact or priority of right or invention shall in any such case be made to appear. And such adjudication if it be in favour of the right of such applicant, shall authorise the Commissioner to issue such patent, on his filing a copy of the adjudication, and otherwise complying with the requisitions of this act. Provided, however, that no such judgment or adjudication shall effect the rights of any person except the parties to the action, and those deriving title from or under them subsequent to the rendition of such judgment.

Sec. 17. And be it further enacted, That all actions, suits, controversies, and cases arising under any law of the United States, granting or confirming to inventors the exclusive right to their inventions or discoveries, shall be originally cognizable, as well in equity as at law, by the circuit courts of the United States, or any district court having the powers and jurisdiction of a circuit court, which courts shall have power, upon bill in equity filed by any party agrieved in any such case, to grant injunctions according to the course and principles of courts of equity, to prevent the violation of the rights of any inventor as secured to him by any law of the United States, on such terms and conditions as said courts may deem reasonable: Provided, however, That from all judgments and decrees of any such court rendered in the premises, a writ of error or appeal, as the case may require, shall lie to the Supreme Court of the United States, in the same manner and under the same circumstances, as is now provided by law in other judgments and decrees of circuit courts, and in all other cases in which the court shall deem it reasonable to allow the same.

Sec. 18. And be it further enacted, That there shall be provided for the use of said office, a library of scientific works and periodical publications, both foreign and American, calculated to aid and facilitate the discharge of the duties hereby required of the chief officers therein, to be purchased under the direction of the Committee of the Library of Congress. And the sum of —— dollars annually is hereby appropriated for that purpose, to be paid out of the patent fund.

Sec. 19. And be it further enacted, That it shall be the duty of the Commissioner to cause to be classified and arranged, in such rooms or galleries as may be provided for that purpose, in suitable cases, when necessary for their preservation, and in such manner as shall be conducive to a beneficial and favourable display thereof, the models and specimens of compositions and of fabrics and other manufactures and works of art, patented or unpatented, which have been or shall hereafter be deposited in said office. And said rooms or galleries shall be kept open during suitable hours for public inspection.

Sec. 20. And be it further enacted, That all acts and parts of acts heretofore passed on this subject be, and the same are hereby, repealed: Provided, however, That all actions and processes in law or equity sued out prior to the passage of this act, may be prosecuted to final judgment and execution, in the same manner as though this act had not been passed, excepting and saving the application to any such action, of the provisions of the fourteenth and fifteenth sections of this act, so far as they may be applicable thereto.

CIRCULATING DECIMALS.

Sir,—Your correspondent, Mr. A. Peacock, seems to be offended at the remarks I made on his rules for circulating decimals. He, no doubt, fancies that it was arrogant in me (a mere country teacher) to dare to question what he, A. P. (a town teacher) chose to assert. He tells me, "that I have done wisely in not giving my name, &c.;" in answer to this I shall only remark, that the scientific readers of the *Mechanics' Magazine* will be the best judges which of us have most cause to be ashamed of our name.

Mr. Peacock states, "that a very short time enabled him to find out two fractions, which, if not identical, very closely resemble those referred to." Yes, I will allow that all fractions when expanded into decimals, and all agreeing to seven places, must be very nearly equal to one another; so much so, that although we were to prefix as many figures after the seventh place as would extend from Whitechapel to Kensington, we would not increase the sum by the ten thousandth part of a farthing, supposing

·4256781 to be the decimal of a £. Perhaps it might be for some reason of this kind that many of our books of arithmetic and encyclopedias have avoided saying much upon this hair-splitting part of arithmetic. Many writers on arithmetic, however, have gone fully into the subject, among whom we may notice Malcolm, Mair, and Hamilton. The subject has also been fully investigated by many writers on algebra when treating on the subject of geometrical progression.

The two fractions Mr. Peacock gives in answer to my question, are $\frac{8302}{19503}$ and $\frac{1177}{2765}$, which produce the corresponding decimals, ·425678100+and ·425678119+; but I must inform him, that neither the one nor the other are the fractions, nor are they exactly of the same value to those I had fixed upon—indeed, I would have considered it as nearly approaching to a miracle if he could have found them out. But did he find out the above fractions from his own rule? I say at once he did not. Mr. Peacock rather peevishly remarks, that it was certainly an oversight of his, &c.—see p. 198. Now, Mr. Peacock himself, in illustrating his rule, assumed only seven places of decimals (G. C. L. took the same number); and yet he finds fault with me because I did not give him more than seven places. But I shall tell him why I did not give him more than seven—for this best of all reasons, that neither of the decimals consisted of more than eight places; so that had I given him more than seven, he would have had them altogether. But even with this hint, he cannot yet (with any prospect of certainty) tell me what the two fractions are which I had fixed upon—either by his own rule, or that of continued fractions.

I should now go on to notice the false principles which Mr. Peacock has promulgated on incommensurable quantities, but as this subject will occupy a considerable space, I must reserve it for another week.

I am, Sir,

Your obedient servant,

A Country Teacher.

SLATE TOP FOR WASH-HAND STANDS.

Sir,—The Carnarvon blue slate, like India-rubber, is used for various purposes. Could it not be used for the table part of wash-hand stands?* Not that it would be as beautiful as white marble, but that it would be handsomer than painted wood, with the paint half washed off, which is too often the case *with* that article of furniture. After polishing the slate, were figures cut in it, possibly it might be made to retain paint; or a kind of mosaic work might be made of it by inserting pieces of white marble in it; or other means might be used to ornament it.

Yours, &c.

An Amateur Mechanic.

SHORT AND LONG SCREW-DRIVERS.

Electric or minor elementary matter lessens pressure on a body, owing to the momentum of its atoms being as their size; to which may be added, the farther from the source of power, the more reduced is the effect, which is exemplified in any system of machinery depending on a single motive power, and turning an extended spindle, the motion of which keeps remote mechanism in motion. The more simple exemplification is that of a turn-screw and the hand. The carpenter imagines, that with equal force of hand a long turn-screw is more powerful than a shorter, because the longer turns a rusty screw, which by a shorter cannot be moved. The fact is, power is lost by the long one: resistance it is which is reduced. The longer is the lesser power. In screwing, the force is in the direction of the required effect forward; in unscrewing, it is the same to produce the contrary effect. A screw of difficult removal is much pressed in a direction the contrary of what is wanted; to make it ascend is the object—pressing it into the wood, the act. In unscrewing, the hand uses its force in two directions —forward, to keep the tool in the slit of the screw; rotary to produce the turning, and consequent ascent of the screw. Lessening the forward force on a screw is the object gained by the longer instrument; the whole of which forward force is got rid of, when the screw has a head

* This application of slate has already been made by Mr. Stirling. See *Mech. Mag.* p. 281.

which admits of a winch. The tool may be uselessly long; the forward force by the hand being as before, it may be insufficient to command the position of the tool in the slit, and too weak to produce any turning effect; or should the slit be deep enough, the greatest effect will be on some part of the blade of the tool in a twisting direction. The carpenter little thinks that his exertion is employed oppositely to his intention or against himself, the turning effort by one hand having to overcome the forward effort by the other. —*Pasley's Natural Philosophy*.

RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal*, for May.)

Doffer for Wool-Carding Machines, *Stephen R. Parkhurst, Providence, Rhode Island*.—Instead of a continuous cylinder, this doffer is composed of a set of wheels, or pulleys, of equal diameter with the common doffer, covered with a card in the same way, of three or four inches thickness at the rims, to revolve like the common doffer, placed upon their shaft, an inch or an inch and a half apart, and at a small angle and parallel with each other, and making such an angle with the shaft as that the spaces between may be fully compensated in their revolution, and the whole surface of the main cylinder be passed over by them; and their rims, or outer surfaces, must be parallel to their shaft, so as to conform to the surface of the main cylinder. Next, there is a set of pulleys, called division rollers; these may be about four inches in diameter, for a common doffer, of the same thickness with the spaces between the different rims, or pulleys, of the doffer, placed upon their shaft at the same angle, turned by a belt, or gear, placed before the doffer, with their shaft a little lower than the shaft of the doffer, and so placed that their outer edges will be a little within the rims of the doffer, for the purpose of keeping the wool on the different parts, or wheels, of the doffer, entirely separate, as it is taken off by the top rolls, hereinafter described. The next are a set of pulleys, or wheels, or rims, called the top rolls; they are equal in number to the different rims of the doffer, four or five inches in diameter; they may be a little less in thickness than the width of the different rims of the doffer, so that the division rolls may revolve freely between them, placed so as to revolve in contact with their correspondent rims of the doffer, for the purpose of taking the wool from it, and so placed as that they will so bear upon the shaft of the division rolls as to be turned by it. A comb, if necessary, may be attached to this doffer, to clear the wool from it. The wool taken from the doffer by these top rolls, kept in separate laminæ, or flakes, by the division rolls, drawn over the shaft of the division rolls, may be passed through a tube, or a belt, and then run on a spool, or spools; or, by a flyer properly placed, it may be at once twisted into a thread. By regulating the feed of the card, and the speed of the division rolls, the size of the roping, and of thread, i. e. the fineness of them, may be regulated, or adjusted, to suit the work required.

Obtaining a Power for Propelling Cars, Boats, &c., *Alexander M'Grew, Cincinnati, Ohio*. — My improvement does not consist in the employment of any newly-invented machinery, but in the using of such power from falls, or currents of water, or other natural or artificial sources of power, as has heretofore been allowed to run to waste, and employing the same for the purpose of condensing of air into suitable receivers; the elastic force of which condensed air is to be subsequently applied to the purposes herein designated. In numerous situations in the courses of canals and railroads, and of other roads and water courses, there are falls of water, waste weirs, dams, sluices, &c., the power from which, if economised, would be ample for the attainment of all the ends proposed by me; I bring this into use by taking the waste power from wheels, or other machinery already erected, or by erecting others where they do not already exist, using any of the known constructions of such wheels, or other machinery, as may be best adapted for the particular situations in which they are to be employed; these I connect in the ordinary way with the piston, or pistons, of condensing engines, constructed for the condensing of air, and force air thereby into suitable receptacles, or reservoirs, furnished with the requisite tubes, valves, or other appendages, by which they are

adapted to the containing of the air thus condensed, and to the supplying of the same in measured quantities, so as to operate upon a piston for driving and propelling machinery, as high steam is now made to operate. The means of doing this does not require any description, being perfectly familiar to competent engineers. The air is to be condensed into one large stationary reservoir, and by means of a connecting-tube and stop cock, transferred therefrom into other reservoirs connected with the vehicle to be propelled. What I claim as my improvement in the art of propelling cars, boats, or other vehicles for transportations, is the employment of the waste power of water, wind, or other natural or artificial sources of power, to the condensation of air, in the manner, and for the purposes, hereinbefore set forth.

Remarks by Dr. Jones.—It has been repeatedly proposed to drive railroad-cars, &c., by means of condensed air, instead of by steam, and to erect stationary engines for the purpose of filling the requisite reservoirs, and we believe that the thing was attempted in England. Were there not serious practical objections to the plan, it would certainly present many advantages, but these are so weighty, that they are not likely to be removed. Among them is the perpetually diminishing power of the condensed air, as every stroke of a piston must lessen its elastic force; to graduate the quantity emitted from the reservoir, in proportion to this diminished force, would be very difficult; and, besides this, there ought, when the reservoir is renewed, to be a pressure of several atmospheres above what is required in a steam-boiler, or it will soon be so far exhausted as to be inadequate to the production of the intended effect, as they would have to be exchanged whilst under a pressure of two or three atmospheres.

The present patentee does not propose to remove the foregoing, or any other objection to the use of condensed air, excepting it be the necessity of erecting stationary engines to effect the condensation; and to accomplish this, he depends upon the employment of means which would generally be more difficult, precarious, and expensive; in many places, the means of condensation proposed to be used would not be found within many miles of the stations where the reservoirs would be wanted, and there are, in fact, but few situations where the means of applying waste power would not be a costly undertaking.

NOTES AND NOTICES.

The Poor Boy.—We delight to trace the progress of genius, talent, and industry, in humble life. We dwell with pleasing emotion on the character and conduct of individuals who, from a "low estate" of obscurity and poverty, have raised themselves, by their own native energy, to affluence and stations of respectability and renown. Our country is full of examples of this description. They fall under our observation every day. Gideon Lee was once a poor boy, and in the occupation of a farmer. He is now in affluent circumstances; recently Mayor of New York, and at present a member of Congress. Charles Wells, late Mayor of Boston, was a journeyman-mason. Samuel T. Armstrong, the acting Governor of Massachusetts, and at the head of several philanthropic institutions, was once a journeyman-printer. There are those living who recollect George Tibbets a day-labourer, and know him now as a gentleman of wealth, influence, and enterprise—the Mayor of the city of Troy. Stephen Warren, the well-known and esteemed President of the Troy Bank, rich in this world's goods, and rich, too, in public spirit and deeds of benevolence, came from an obscure town in Connecticut, penny'ess—a shoemaker. Perseverance, energy, and industry, and moral worth, produced this consummation of human wishes.—*New York Messenger.*

Railroad to India.—Long before ten years more, I trust to see a regular communication, in 45 days, between England and India, in every month of the year, established on a permanent and well-organised footing. That the communication can be accomplished in 45 days is beyond a doubt, even allowing nine days for the several necessary stoppages.—*Mr. Waghorn, in a letter dated Alexandria, April 7, published in the Morning Chronicle of May* 11.

Communications received from Mr. Hodson—S. S. (next week)—Mr. Hennell—Mr. Dickson—A Projector—A Subscriber—Mr. Briggs.

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C. E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

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IMPROVED MODE OF TRACTION THROUGH CANAL TUNNELS.

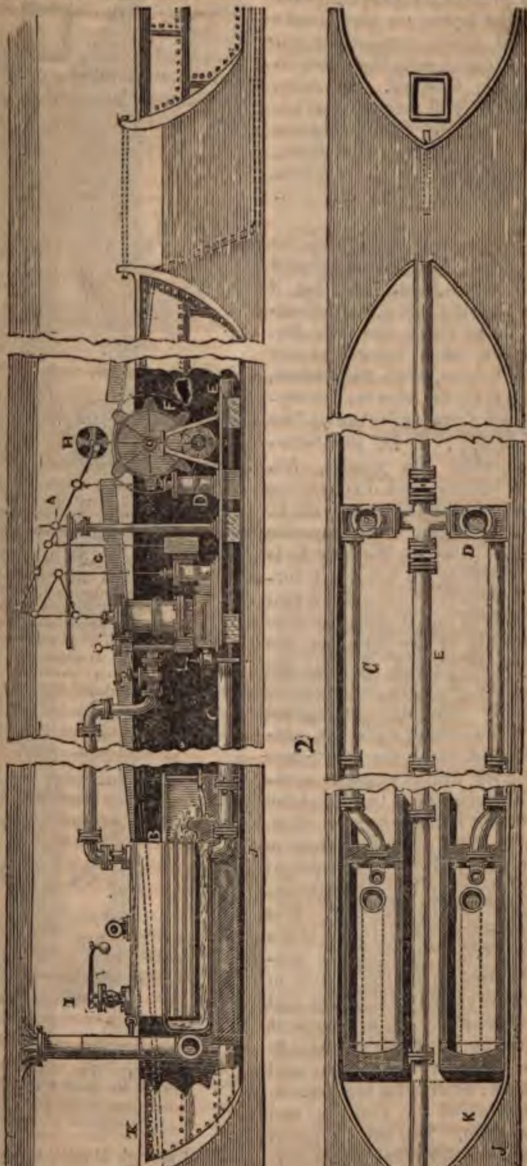


Fig. 1.

2

IMPROVED MODE OF TRACTION THROUGH CANAL TUNNELS.

The tunnel on the summit level of the Huddersfield Canal is 3½ miles in length. The method at present for passing boats through is by men laying on their backs on the boats, and acting against the top and sides of the tunnel with their feet to propel the vessels forward. In July, 1834, a premium of 100 guineas was offered for the best plan for facilitating the passage of the boats through the tunnel, provided it was adopted ; in consequence of which, the following plan was projected :—

Fig. 1 is a longitudinal section of the engine, boiler, &c. Fig. 2 is a ground plan of boilers, pipes, boat, &c. Fig. 3 is another plan, giving a top view of engine, boilers, taup, chain, trough, &c. A A, the engines, of 5 horses' power each ; B B, the boilers, with their tubes, chimneys, &c.; C C, the pipe for conveying the smoke, &c. from under the boilers to the force-pumps ; D D, the force-pumps for drawing the smoke, &c. from under the boilers, and discharging it into the canal J through the pipes E E. The smoke is discharged in an opposite direction to that in which the boat K is moving, thus assisting to propel it forward. It will be perceived in fig. 2 that the smoke is forced out at either end of the boat, according to the direction she is moving, by opening and shutting the stop-valves at the junction between the two pumps. By this aforementioned arrangement I do away with the nuisance of the smoke, cause the air to pass freely through the fire to support combustion, and likewise assist to propel the vessel forward. It is necessary to state, that the steam is to be got up previous to entering the tunnel ; then the damper of the chimney is shut, and the pumps become substitutes for the chimney. F is the taup-wheel, which works in the chain for drawing the boats through the tunnel. G is the trough in the centre of boat, which conveys the chain L to and from the taup-wheel. This trough is raised in the centre to allow the water to run back into the canal that is brought up with the chain ; as also for the ascending and descending of the chain to and from the taup-wheel. The trough forms round the taup-wheel, except where it is in contact with the chain, to prevent any water running into the boat. The bottom

Fig. 3.

of the trough should have friction-rollers, to keep the chain and the bottom of the trough from wearing. H is a small wheel

which is driven round by the taup-wheel to prevent the chain from rising off it in case of jerks, &c. In fig 3 the chain is seen going over the taup-wheel, and extending from one end of the tunnel to the other, made fast at each end, and laying at the bottom of canal; ascending on to the taup-wheel, and falling again into the canal, as the boat moves along. The chain is of simple construction, easily manufactured and soon repaired in case of accident; it weighs 36 lbs. to the yard.

Fig. 4.

Fig. 4 is a side-view of the valves which are to be opened and shut alternately, as the boat is reversed in her direction through the tunnel, to admit of the smoke being forced out in the opposite direction to that in which the boat is moving. The speed of the taup-wheel determines the speed of the boat, consequently any speed can be attained that is practicable in a close tunnel.

Your obedient servant,

EMANUEL WHARTON.

Manchester, April 26, 1836.

P.S.—It will be proper to inform you that I never had the opportunity of explaining the plan to the Canal Company, nor any one else that sent plans. The engineer, to whom the competing plans were submitted, advised the Company not to adopt any of them, but to use stationary engines.—E. W.

DUST PROTECTORS.

Sir,—We have in this country contrivances to keep us from the wet and from the cold, why not from the dust? When some men go from home, it suits them to have but one coat, and it does not suit them to have it made shabby; and if he does not put on an upper coat, must be the case, which does not exactly do this hot weather. Under those circumstances, had he a thin brown Holland garb to put on, would it not be serviceable? Would not a thin light covering for clothes and hats find a ready sale in the London ready-made cloth shops.

AN OCCASIONAL TRAVELLER ON THE COACH TOP.

HISTORY OF THE FOUNDATION OF THE BRITISH MUSEUM.

Sir,—As you have occasionally devoted some of your pages to the subject of our national Museum, with a view to its improvement and the extension of its public utility, I venture to transmit to you some particulars respecting its foundation, not generally known, and which are not to be found in the article "British Museum," lately published in the *Penny Cyclopedia*, and which common report attributes to the pen of Sir Henry Ellis. The following sketch has been compiled with great care, principally from contemporary writers whose authenticity may be relied on.

I am, Sir,

Your obedient servant,

S. S.

June 1, 1836.

Sir Hans Sloane, the founder of the British Museum, one of the most eminent physicians and naturalists of the eighteenth century, of whom an interesting memoir may be found in the *Biographia Britannica*, was not only distinguished as a man of science, but also as a liberal and patriotic citizen. He was a governor of most of the metropolitan hospitals, to which he was not only a constant benefactor, but also left considerable sums to them at his death. He set on foot the scheme of a dispensary for the poor, and gave to the Apothecaries' Company a piece of ground at Chelsea for a botanic garden, who, "that their successors and posterity might never forget their common benefactor," caused a marble statue by the celebrated Rysbrach to be erected to his memory. Sir Hans Sloane was also instrumental in establishing the Foundling Hospital, and formed the plan for bringing up the children, which proved the best that could be devised. He was the first who introduced into England the general use of bark, which he applied successfully to the cure of many diseases. Sir Hans Sloane also gave a sanction to the practice of *inoculation* by inoculating two of the princesses, which more effectually established this great discovery than all the treatises that had been written on the subject. But the share he had in the foundation of the British Museum will most effectually preserve his name from oblivion. Having with great labour and expense, during the course of his

long life,* collected a rich cabinet of medals, objects of natural history, &c., and a valuable library of printed books† and MSS. He bequeathed the whole to the public on condition that the sum of 20,000*l.* should be paid to his executors for the benefit of his family, but which, according to his own declaration, in a codicil to his will, made a short time before he died, was not a *fourth* part of the then intrinsic value of his museum.‡ And it should be remembered, that the sum of 80,000*l.* expended in the first half of the eighteenth century in the purchase of MSS., rare books, coins, gems, antiquities, and other curiosities, would produce a very different result in point of quantity and quality from the same amount devoted to similar purposes at the commencement of the nineteenth,—when a single MS. was sold for 2,000*l.* or 3,000*l.* It may be safely asserted, therefore, that 200,000*l.* would now scarcely purchase such a collection as Sir Hans Sloane's was in the year 1753.

The following list of articles contained in Sir Hans Sloane's museum is given in the *Biographia Britannica* (art. Sloane), which was published in 1763, only four years after the opening of the Museum to the public; it is a curious and important record, and as it was probably communicated to the writer of Sir Hans's life by an officer of the British Museum, it may, we think, be entitled to all the credit of an official document.

Medals and coins, ancient and modern	22,000
Antiquities, &c., about	1,125
Seals, &c.	268
Cameos and Intaglios, &c., about	700
Precious stones, agates, jaspers, &c.	542
Crystals, spars, &c.	1,864
Fossils, flints, and stones, &c.	1,275
Metal, mineral ores, &c.	2,725
Earths, sands, salts, &c	1,035
Bitumen, sulphurs, ambers, ambergris, &c	399
Talcs, micæ &c	388
Testacea or shells........................	5,834
Corals, sponges, &c.	1,421
Echini, echinites, &c.	659
Asteriæ, trochi, entrochi, &c.	241
Crustacea or crabs, &c.	363
Stellæ marinæ, &c.	173
Fishes and their parts	1,555
Birds and their parts, of different species..	1,172
Vipers, serpents, &c.	521
Quadrupeds, &c.	1,886
Insects...................................	5,439
Humana and calculi; anatomical preparations	756
Vegetables, as seeds, gums, woods, roots, &c.	12,506
Hortus siccus, or volumes of dried plants..	334
Miscellaneous things, natural, &c.	2,098
Pictures and drawings, &c., framed	310§
Mathematical instruments	55

Another list of the objects of Sir Hans Sloane's Museum is printed in the introduction to the British Museum Synopsis for 1815 (p. 3, note), in which it is said, that the quadrupeds and their parts amounted to 8,186, and the stones, ores, bitumens, &c. to 9,942. This account is stated to have been made up from a schedule handed about at the time of the purchase; its authenticity, however, is not vouched for. But why not quote the contemporary account in the *Biographia Britannica*, or refer at once to the catalogue itself for information? It was surely accessible to the person who compiled this introduction!

"Besides this mass of curiosities," continues the writer in the *Biographia Britannica*, "his library consisted of more than 50,000 volumes (347 of which were illustrated with cuts finely engraven and coloured from nature), 3,566 MSS., and an infinite number of rare and curious books."‖ Of the Sloanean MSS. the *Penny Cyclopedia* (art. British Museum,) furnishes the following, as we are told, *demi-official* account. "This collection principally consists of MSS. on natural history, voyages, and travels, upon the arts, and especially upon medicine. It comprises the chief of the celebrated Kœmpfer's MSS., with the voluminous medical collections of Sir Theodore Mayerne, and amongst them the annals of his practice in the court of England from 1611 to 1649. It also contains a collection of medical and other scientific correspondence, with numerous MSS. on history, poetry, and miscellaneous subjects."

We have no objection to a demi-official account of the British Museum in the Penny or any other Cyclopedia;¶ but why do not the

* He died in 1753, in his 92nd year.

† A remarkable instance of Sir Hans Sloane's liberality, as regarded his library, is worthy of record. If he found that he possessed duplicates of any books which related to medicine, he was accustomed to present them to the College of Physicians, and if they treated of other subjects, to the Bodleian Library, a rare, and, we are afraid, solitary example of disinterestedness and devotion to the cause of literature and science.

‡ In the *Penny Cyclopedia* 50,000*l.* is the sum named. But this is the amount mentioned by Sir Hans in his will, which was made in the year 1739. The compiler of this article could never have seen the codicils, or he would not have committed so gross an error.

§ Dodsley, in his Guide (1761,) enumerates some of the principal portraits, forty-six in number, of kings of England and of numerous distinguished individuals. Some of these, we believe, are now exhibited in the Mineral Gallery, at the Museum, but the transverse light from the double horizontal skylights renders it extremely difficult to choose any position from which they may be seen with advantage. Why are not these portraits transferred to the National Gallery, where Sir George Beaumont's and the Rev. Holwell Carr's pictures, bequeathed to the Museum, are very properly placed?

‖ It must always be a matter of regret that any of Sir Hans's books should have been *sold*. A considerable number, it is said, were "turned out" as duplicates only a few years since. These were the founder's books, and should never have been disposed of; but many belonging to the Royal Library of the kings of England, given by King George II., have shared the same fate.

¶ See *Mechanics' Magazine*, May 23, 1836, vol. xxiv. p. 39.

Trustees direct a sketch of the history of the Museum to be prefixed to the Synopsis or Guide? This was done seventeen or eighteen years ago, but has been discontinued. That this guide is susceptible of great improvement in other respects, was admitted by the officers themselves when examined before the Committee of Inquiry last session. See the Natural History Evidence, passim. In pp. 60, 61, and 65, of the Synopsis published in 1835, we are informed (*mirabile dictu*), that the flesh of the salmon furnishes "one of the greatest delicacies of the table;" that the "flesh of the cod is white, regularly separates into flakes, is easy of digestion, and very palatable," and that "the flesh of the sturgeon is excellent!!!" As the Synopsis is now said to be out of print, we trust that something more worthy of a national Museum will be produced. The price also should be reduced one-half, at least. See Evidence, No. 2769, 2794, and Appendix, p. 444. From the catalogue of printed books (1817), it would appear that the Museum does not possess a complete set of its own Synopsis; it is also no less strange than true, that no authorised guide to the curiosities of the place was published for nearly half a century after it was opened.

"It is easy to perceive," observes the writer in the *Biographia Britannica*, "the advantage that will result to the public from this immense collection. To have access to such a cabinet as this is, in effect, to men of taste, like *making the tour of the world*, and having for their tutor a catalogue of thirty-eight volumes in folio, and eight in quarto, containing a short description of each curiosity, with a reference to the authors that treat of it more at large."

From the "British Chronologist" (vol. iii. p. 130, col. 2), we learn that when the will of Sir Hans Sloane was proved, "Administration was granted to the Lord Cadogan and Dr. Sloane Elsmere, Rector of Chelsea. The will consisted of five sheets of paper, all written with his own hand; and there were nine codicils to it. The testator, desirous that his collection *might be kept entire*, directed it to be offered to his Majesty at 20,000*l.*; and if this offer was declined, then first to the Academy of Sciences at St. Petersburgh, and then successively to the Royal Academy of Sciences at Paris, Berlin, and Madrid. If the King and Parliament accepted the offer, Sir Hans' trustees* were to apply for a power to enable them to preserve, maintain, and continue the collection at Chelsea, where it was to be shown, under proper regulations, for the satisfaction of the curious and the improvement of knowledge." In the second codicil Sir Hans observes, "Having had from my youth a strong inclination to the study of plants, and all other productions of nature, and having through the course of many years, with great labour and expense, gathered together whatever could be procured, either in our own or foreign countries, that was rare and curious, and being fully convinced that nothing tends more to raise our ideas of the power, wisdom, goodness, providence, and other perfections of the Deity, or more to the comfort and well-being of his creatures, than the enlargement of our knowledge of the works of nature, I do will and desire that for the promoting of these noble ends, the glory of God, and the good of man, my collection, in all its branches, may be, if possible, *kept and preserved together whole and entire* in my manor-house at Chelsea, &c." Sir Hans afterwards appoints several persons as a Board of Visitors, "to visit, correct, and reform, from time to time, as there may be occasion, either jointly with the said trustees or separately, &c.;" and had this valuable regulation been attended to by the Legislature in framing the Act of Incorporation for the British Museum, there would, probably, have been but little necessity for a Parliamentary inquiry.

From the respectable authority already quoted we extract the following interesting account of the proceedings which took place after the death of Sir Hans:—

"1753—Jan. 27. The Lord Cadogan and the other executors of the late Sir Hans Sloane, Bart., having desired the trustees who were appointed by Sir Hans *to take care and keep together his Museum*, to meet at the Manor-house at Chelsea, at ten in the morning, they met there, accordingly, about forty. Lord Cadogan was there, and received them in the politest manner; and having caused the galleries, libraries, and all the other apartments, to be shown, they assembled in the great room, where his Lordship produced Sir Hans' will, and acquainted the trustees with the codicils, the nature of which has been already detailed. In case the offer was accepted as to the Museum remaining at Chelsea, he gave the Manor-house there,† with the Museum, as it is now disposed,

* These were 58 in number, containing the names of some of the most distinguished persons, scholars, and philosophers, of the day, both English and foreign. Among the foreigners who are trustees are, it is curious to remark, the names of the Rt. Hon. Henry XXVIII. Count of Reuss; the Rt. Hon. and Rev. Count Zinzendorf, the Lord Advocate, and of the Chancellor and Agent of the United Fratrum, a sect founded by Count Zinzendorf, and afterwards known by the appellation of "Moravians."—Vide British Chronologist, vol. iii. pp. 136, 137.

† Sir Hans' trustees having afterwards consented to the removal of the Museum from Chelsea, the Government gave them the Manor-house to be disposed of, along with his other property, for the benefit of the family.—*Biographia Britannica*, art. Sloane.

which would save the expense and hazard of removing the same; to be kept open, at proper hours, for the access of the studious and curious. Then Mr. Sloane acquainted the trustees that the executors being apprehensive of danger, *the medals, of which there were great quantities of gold and silver, besides a series of curious copper ones, and the precious stones, such as pearls, rubies, emeralds, &c., and the vases of gems, &c.*, had been removed for safety to the Bank of England, and that two of the executors had seen them all packed up. The Earl of Macclesfield having been desired by the trustees to take the chair, the will and codicils were read. Lieutenant-General Oglethorpe* gave an account of the intention of Sir Hans, of the nature and value of the Museum, and produced an abstract of the articles it contained;† and desired that Mr. James Empson, who had taken care of the Museum for many years past, by Sir Hans Sloane's order, should read the abstract and explain the articles, which he did accordingly, and was appointed their Secretary by the trustees. Sir George Littleton then moved, and Mr. West seconded, that a memorial should be presented to his Majesty relating to this matter, and a Committee was appointed to draw up the memorial, and lay the same before a general meeting of the trustees." This having been done, on June 7, 1753, an Act of Parliament was passed for purchasing Sir Hans Sloane's Museum, and also the Harleian collection of MSS., and for providing a general repository for the same, as also for the Cottonian Library, by a lottery. This is the Act of Incorporation of the British Museum, that body not having yet obtained any charter. Montague House was afterwards purchased by the Government for 10,000*l.*; and the various collections having been removed to this depository, the British Museum was opened for public inspection on the 15th of January, 1759.

Among the *first elected* Trustees appointed to conduct the new establishment, were several persons eminent for learning and science; viz., the Right Honourable Philip York, author of the justly celebrated "Athenian Letters;" Sir George Lyttleton, Bart., afterwards Lord Lyttleton, the well-known author; Sir John Evelyn, Bart., son of the celebrated Sir John Evelyn, and himself an author; Nicholas Hardinge, Esq., a Barrister, author of Latin Poems, and distinguished for the cultivation of the Belles Lettres; the Rev. Dr. Birch, Secretary of the Royal Society, and author of many well-known biographical and historical works; Dr. John Ward, Professor of Rhetoric at Gresham College; and Mr. William Watson, afterwards Sir William Watson, a celebrated physician of the day.‡

The *Biographia Britannica* (art. Sloane,) presents us with a curious account of the first establishment of *officers*, which consisted of a Principal Librarian§ at 200*l.* a-year; three Under Librarians, 100*l.*; three Assistants, 50*l.*; a Keeper of the Reading-room, 50*l.*; a Porter and Messenger, 50*l.*; one man, 30*l.*; and four women servants; which would probably amount to 900*l.* a-year, and notwithstanding the insignificance of their pay, "the officers were remarkable for being a sensible and learned set of men;"‖ the salaries of the officers, assistants, attendants, &c. in 1835, was more than *eleven thousand pounds*:¶ between the years 1823 and 1835, 393,600*l.* has been spent on the new buildings; and the other grants by Parliament, from the year 1753 to 1835, amount to 619,661*l.*!** These facts being upon record, we cannot see with what justice the secretary of the Museum can complain of "*the necessity of perpetual reference to the House of Commons; of the jealousy of that House in regard to the mode in which the public money is expended, the clamour more or less prevalent for economy, furnishing sometimes a reason for declining expense*, AND ALWAYS A CONVENIENT EXCUSE, *as obstacles to the improvement of the British Museum; and as tending to prevent that course of* DIGNIFIED LIBERALITY *which is best calculated to secure the respect and affection of the people, and to promote their wealth and happiness.*"†† Admitting that this censure applies to past governments, the present executive must be exempted from any such caustic observations. In August, 1835, in addition

* This gentleman, with Archbishop Potter, patronised Count Zinzendorf, and obtained an Act of Parliament for the protection of his followers throughout the British dominions.

† Already given in p. 260.

‡ *Universal Magazine*, for December, 1753, vol. xiii. p. 283.

§ It is a curious fact, that the three first persons who held this office were *physicians*, viz., Dr. Knight, Dr. Maty, and Dr. Moxton. Joseph Planta, Esq., F.R.S., succeeded the latter in 1799, and for twenty-eight years discharged the responsible duties of his office in a manner which excited the admiration, and gained for him the esteem of every one who had occasion to seek his assistance. His uniform courtesy of manners and gentlemanly deportment, as well as his proficiency in modern languages—which enabled him to pay proper attention to the many distinguished foreigners who visited the Museum—must be fresh in the recollection of many of our readers. Mr. Planta was at once "a scholar and a gentleman." *Heu valde deflendus!*

‖ Dodsley, Introduction, p. 6.

¶ 11,082*l.* 8*s.*; the whole expenditure being 19,076*l.* 4*s.*—Vide Annual Parliamentary Account for 1835, presented in 1836.

** British Museum Report, 1835. Appendix, p. 568.

†† Ibid. Evidence, No. 623.

to the sums above stated, the British Museum received a special grant of 6000*l.* for the purchase of Mr. Salt's Egyptian Antiquities; and in the present year they have been enabled to obtain by the liberality of the Treasury, without applying to Parliament, Mr. Sheepshanks's magnificent collection of Dutch etchings, which cost 5000*l.*; a portion of Mr. Heber's MSS. of the value of 2000*l.*; the celebrated collection of Durand vases, said to be greatly superior to the Hamilton collection, the price of which has not yet transpired; and lastly, the unique Bible of Alcuin and Charlemagne, which was bought in at Mr. Evans's for 1500*l.*, but which has since been purchased by the Museum for a less sum.

After this, let us hear no more of the "obstacles to the improvement of the British Museum;" the only real "obstacle" to its improvement, and to the consequent extension of its public utility, is to be found in the *defective constitution* of that establishment, so pertinaciously defended by two of its leading officers.* Let us hope, however, that when the present Committee of Inquiry make their Report to the House some plan may in consequence be adopted which will effect the desired result.

We cannot conclude this brief history of the foundation of the British Museum without expressing our surprise and regret, that the British public, or rather those by whom the people are represented, should be so indifferent to the memory of Sir Hans Sloane as not even to exhibit a memorial of this illustrious man in any part of the Museum visited by the public. On entering the hall of this establishment, where it would naturally be expected that some such memorial should be found, we seek in vain for any "storied urn" or "animated *bust*" that shall remind us of the magnificent bequest of one of the greatest men of his day. But what are the objects presented to our view? A statue of Shakspeare, by Roubilliac; another of Sir Joseph Banks,† a very different person from the immortal bard of Avon; a gilt figure of Gaudma, a Burmese idol; and the statue of the Hon. Anne Seymour Damer (who gave a Napoleon snuff-box to the Museum), holding in her arms a pretty little naked baby, said to represent the "Genius of the Thames." All this incongruous array doubtless puzzles many of the simple folk who visit the Museum, and we have occasionally overheard many learned discussions as to which of these august personages the honour of founding the Museum belongs. It may be said, perhaps, by the Trustees that Sir Hans' "Collections" are the best statue that could be erected to his memory—*si monumentum requiris, circumspice!* but suppose it should turn out that a *bust* of Sir Hans Sloane was formerly in the possession of the Museum, will it be considered *crimen læsæ majestatis* to inquire what has become of it? Is it placed in the Medal Room,‡ together with the busts of Sir Thomas More, Dr. Samuel Clarke, and a noble bust of Homer in bronze, of the most exquisite Greek sculpture, said to have been found near Constantinople?§ And, like the coins, medals, and gems,‖ and certain MSS., are these "busts" become "select," and to be inspected only by "particular permission," and "by a few persons at a time?" Or has the bust of Sir Hans been consigned to the obscurity of some attic? Or has old *Tempus edax rerum* crumbled this frail memorial into its original dust? Arise, shade of Sir Hans! and haunt the nightly slumbers of the Curators till "the bust" be restored to its "pedestal on the staircase,"¶ where, in the year 1784, it was still to be seen, but where the "musk-ox" now presents itself to our gaze.

Although no notice can be found of Sir Hans Sloane's bust, or of those just enumerated, in the "Museum Synopsis" of 1835, *another bust* is named with the most elaborate praise—that of Mr. Charles Townley, whose collections were purchased by the Government, after Committees of the House of Commons had been appointed to ascertain their commercial value; and although it may be quite proper to preserve *his* bust, it should not supersede that of the founder of the Museum. There is also in the Print Room a portrait of Sir William Hamilton, whose collection was purchased. We seek in vain, however, for any memorial of Sir Hans Sloane; his name occasionally figures in the "Synopsis," but only in company with other donors. This ought to be remedied forthwith; for we are old-fashioned enough to think with Herodotus, that "*Things past ought not to be extinguished by length of time, nor great and admirable actions remain destitute of glory.*"

S. S.

* See the Evidence of Sir Henry Ellis and Mr. Forshall, passim.

† There is also a *portrait* of Sir Joseph Banks, by Lawrence, in the Cracherode Room.

‡ "A few modern busts, some of which belonged to Mr. R. P. Knight, are preserved in the Medal Room."—*Penny Cyclopedia*, art. British Museum. And it may be added, a bust of some unknown female in the Magna Charta Room; of this presiding *déesse* we know nothing.

§ Dodsley's General Contents of the British Museum, 8vo. 1761, p. 4. and Companion to the Principal Places in London and Westminster, 12mo. 1784, p. 94. The bronze bust of Homer is also noticed in Harris's Curiosities of London and Westminster for 1805, p. 175, but there is no mention of the bust of Sir Hans Sloane.

‖ When the Museum was first opened, the Pontifical medals were exhibited in glass cases; and in the year 1784, a series of French medals, beginning with those of Pharamond. See Dodsley, p. 18; Companion, p. 100.

¶ Companion to Lond. and Westm. 1784.

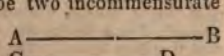
ON THE DOCTRINE OF INCOMMENSURABLE QUANTITIES.

Sir,—I shall now proceed, according to promise, to make a few remarks on the false principles which Mr. Anthony Peacock has promulgated on the arithmetic of incommensurable quantities, in the concluding part of his article in the *Mechanics' Magazine*, No. 672.

He asserts, that it would be absurd, and contrary to all our experience, to suppose that the square root of a surd number, when decimally expressed, follows no regular law. I am willing, he adds, to pay respect to the opinions of the learned, &c.

From the above it appears, that Mr. A. Peacock imagines that I am the first person that ever asserted that the square root of 2 could not be expressed by a rational fraction. Well, I shall suppose I am wrong, and that it ultimately does produce a recurring decimal. Let this decimal be expressed by an equivalent fraction $\frac{m}{n}$, then $\sqrt{2} = 1 + \frac{m}{n} = \frac{n+m}{n}$ $\therefore$ the side of a square being 1, the diagonal will be to the side of the square as $\frac{n+m}{n} : 1$. But $1 = \frac{n}{n}$ $\therefore$ the diagonal of a square is to its side as $\frac{n+m}{n} : \frac{n}{n} :: n+m : n$, that is, if the side of a square be divided into n parts (m and n being both, by hypothesis, finite numbers), the diagonal will contain $m+n$ of such parts. Now, this is completely at variance with what has been demonstrated by Euclid. Legendre, Leslie, and many others, all of them great geometers, have demonstrated this general property of incommensurate quantities.

If AB, CD, be two incommensurate lines, no part of the line AB, however small,



will measure the line CD. This certainly at first appears to be paradoxical, but still it is true. That the side of a square is incommensurate to its diagonal is the 117th proposition of the 10th book of Euclid; and that great geometer, Dr. Barrow, in his "Elements of Euclid," gives the following singular quotation, after demonstrating the said proposition:—"*This theorem was of great* note with the ancient philosophers; so that he who understood it not, was esteemed by Plato undeserving the name of man, but rather to be reckoned among brutes."—*Barrow's Euclid*, p. 233.

The proposition may be algebraically demonstrated as follows:—

Suppose we have a continued fraction, in which the denominators, after a certain number of changers, begin to repeat in the same order, such as the fraction,

$$c + \cfrac{1}{a + \cfrac{1}{b + \cfrac{1}{a + \cfrac{1}{b}}}}, \text{ \&c. to infinity.}$$

$$\text{assume } x = \cfrac{1}{a + \cfrac{1}{b + \cfrac{1}{a + \cfrac{1}{b}}}}, \text{ \&c.}$$

then, after a little consideration, we obtain the equation,

$$x = \cfrac{1}{a + \cfrac{1}{b+x}}$$

$$\text{or } x = \frac{b+x}{ab+ax+1}$$ and solving this quadratic, we obtain $x = \frac{1}{2}\left(\sqrt{b^2 + \frac{4b}{a}} - b\right)$ assume $c = 1$, $a = b$, and each equal to 2, then $x = \frac{1}{2}(\sqrt{8} - 2) = \sqrt{2} - 1$; hence $c + x = 1 + x = \sqrt{2}$. In the same way, if $c = 1$, $a = 1$ and $b = 2$, then $1 + x = \sqrt{3}$, or if $c = 2$, $b = 4$, $a = 4$, then $2 + x = \sqrt{5}$.

From which it appears, that

$$\sqrt{2} = 1 + \cfrac{1}{2 + \cfrac{1}{2 + \cfrac{1}{2 + \cfrac{1}{2}}}}, \text{ \&c. to infinity,}$$

or the approximating values of $\sqrt{2}$, will be $\frac{1}{1}$, $\frac{3}{2}$, $\frac{7}{5}$, $\frac{17}{12}$, $\frac{41}{29}$, $\frac{99}{70}$, $\frac{239}{169}$, $\frac{577}{408}$, &c. to infinity; that is, the fraction

that exactly represents the square root of 2 must have an infinite number of figures in both its numerator and denominator, and at the time in its lowest terms, that is, no finite fraction can be exactly equal to the square root of 2; and the same may be proved of 3, 5, 6, 7, 8, 10, 11, &c.

But the best algebraical demonstration I have ever seen of this proposition is given in the English translation of Euler's "Algebra," by Professor Barlow, of Woolwich. The demonstration is founded upon the following property of numbers, taken from the *Essai sur la Theorie des Nombres*, by Legendre.

Prop. If P be a prime number, and divides neither of the two numbers, A nor B, it will not divide their product, A B.

For the demonstration of this proposition, see Euler's "Algebra," vol. ii. p. 451. From this proposition Mr. Barlow demonstrates that the square root of any integer number not a square, or the cube root (or any root whatever) of any integer number not a cube, cannot be expressed by a rational fraction. See p. 452. I trust now, Mr. Editor, that I have fully made out what I asserted in No. 670, and that the principles promulgated by Mr. A. Peacock are false.

I am, Sir,
Your obedient servant,
A Country Teacher.

P. S.—I intend in the course of another week to send you an article, showing that the method of finding the longitude at sea recommended by Mr. Waldron, No. 674, can be of no practical utility.

A BILL TO AMEND THE LAW RELATING TO LETTERS PATENT FOR INVENTIONS, AND FOR THE BETTER ENCOURAGEMENT OF THE ARTS AND MANUFACTURES.

Whereas it is expedient to alter and amend the law relating to Letters Patent for inventions, as well by rendering more easy and less expensive the manner of securing to individuals the benefit of their inventions, as by affording additional facilities to patentees for the protection of their rights: and whereas an Act was passed in the twenty-seventh year of the reign of King George the Third, intituled, "An Act for the Encouragement of the Arts of designing and printing Linens, Cottons, Calicoes, and Muslins, by vesting the Properties thereof in the Designers, Printers, and proprietors for a limited time," which said Act was, by another Act made in the twenty-ninth year of the reign of his said Majesty King George the Third, continued from the expiration thereof until the first day of July, one thousand eight hundred and thirty-four: and whereas an Act was passed in the thirty-fourth year of the reign of his said Majesty King George the Third, intituled, "An Act for amending and making perpetual the said Act made in the twenty-seventh year of the reign of his said Majesty:" and whereas an Act was passed in the fifth and sixth years of the reign of his present Majesty, intituled, "An Act to amend the Law touching Letters Patent for Inventions:" and whereas it is expedient that the provisions of the said three first recited Acts should be improved and enlarged; be it therefore enacted, that the whole of the said recited Acts of the twenty-seventh, twenty-ninth, and thirty-fourth years of the reign of King George the Third, and also the said recited Act of the fifth and sixth years of the reign of his present Majesty, so far as the said last mentioned Act relates to the notice of objections to be given by the defendant to the plaintiff on pleading to any action brought by him for infringing any Letters Patent, shall be and the same are hereby repealed, but so as not to affect any thing done or executed in pursuance thereof respectively, or any such matter or thing now in progress under the authority of the said Acts respectively.

And be it further enacted, That all Letters Patent for inventions to be hereafter obtained for England, Scotland, and Ireland, may be granted upon the condition to be expressed in such Letters Patent; that the person or persons so obtaining such Letters Patent shall, within *six* calendar months next after the date thereof, enrol a specification in England in the usual manner now practised in England; and shall also within the same period enrol or deposit in Scotland and in Ireland, in the usual places of enrolment or deposit of specifications in Scotland and in Ireland respectively, a specification of the said invention: provided always, that all fees and emoluments whatsoever now due and of right payable on the obtaining of Letters Patent shall continue to be paid and payable to the several persons now or hereafter to become entitled thereto, or to any part thereof: provided always, that in every case wherein the conditions aforesaid shall be complied with, all Letters Patent which shall hereafter be granted containing the aforesaid conditions shall be as valid and effectual in the law for protecting the several persons, grantees, assigns, or otherwise, who shall hereafter obtain such Letters Patent in England, Scotland, and Ireland, regarding the benefits to arise therefrom, as if separate Letters Patent had been obtained in the manner heretofore in use in England, Scot-

land, and Ireland respectively: provided always, that all persons who shall be desirous of availing themselves of the provisions of this Act shall be required to procure such Letters Patent in the same manner as heretofore in use in obtaining Letters Patent for England.

And be it further enacted, That from and after the passing of this Act there shall be raised, levied, and paid unto and for the use of his Majesty, his heirs and successors, in and throughout the whole of Great Britain and Ireland, for and in respect of all Letters Patent to be hereafter obtained for the protection of inventions, and in respect of the specifications of the same, the sum of two pounds sterling only; one pound thereof to be levied by a stamp of that amount, to be impressed on the first page of every petition to be hereafter presented by any person or persons who shall hereafter petition his Majesty for the grant of his said Letters Patent, and one pound sterling thereof to be in like manner impressed upon every specification to be enrolled under and by virtue of this Act, any usage, law, or custom, now existing to the contrary notwithstanding.

And be it further enacted, That in order to prevent the delay that hath heretofore arisen in obtaining Letters Patent for inventions, it shall and may be lawful for any person who shall hereafter be desirous of obtaining Letters Patent for the sole making, exercising, vending, or using of any invention, when and as soon as he shall have obtained the report of his Majesty's Attorney or Solicitor-General upon the propriety of granting the same (provided always, that the said report of his Majesty's said Attorney or Solicitor-General shall be in favour of such grant), to make application to the Lord Chief Justice of his Majesty's Court of King's Bench, the Lord Chief Justice of the Court of Common Pleas, or to the Lord Chief Baron of the Court of Exchequer, or some or one of them, for a warrant to be signed by him, directed to his Majesty's said Attorney or Solicitor-General, directing and empowering him to prepare a Bill in the manner heretofore in use in England; and that the warrant of such Lord Chief Justices or Lord Chief Baron respectively shall be as valid and effectual for empowering his Majesty's said Attorney or Solicitor-General to prepare such Bill as aforesaid, as if the signature of his Majesty had been obtained thereto.

And be it further enacted, That for the purpose aforesaid, it shall and may be lawful for any person so desirous of obtaining his Majesty's said Letters Patent for an invention, when and as soon as his Majesty's Attorney or Solicitor-General shall have affixed his signature to the Bill prepared by him in the manner heretofore in use for his Majesty's Royal signature, to cause a further application to be made to the said Lord Chief Justice of the King's Bench, Lord Chief Justice of the Court of Common Pleas, or Lord Chief Baron of the Court of Exchequer, praying him or one of them to affix his signature to the said Bill.

And be it enacted, That in every case when the said Lord Chief Justices or Lord Chief Baron respectively shall think fit to comply with the prayer of such application, the signature of such Lord Chief Justices respectively or Lord Chief Baron shall be as valid and effectual in the law for the purpose expressed in the said Bill as if his Majesty's signature had been affixed thereto: provided always, that nothing herein contained shall be taken or held to render it unnecessary to obtain his Majesty's Royal signature to all Letters Patent for inventions when and as soon as the same can readily be obtained thereto.

And be it further enacted, That in all Letters Patent for any invention to be applied for after the passing of this Act, the day of presenting the petition to his Majesty for the grant of such Letters Patent shall be held and taken to be the date of such Letters Patent: provided always, that the specification of the invention for which the said Letters Patent shall be obtained shall be enrolled in the manner heretofore in use in England within nine calendar months from the day of presenting the said petition: and provided also, that the term for which the sole making, exercising, vending, or using of any invention to be hereafter secured by any Letters Patent shall bear date from the day of sealing of the said Letters Patent.

And be it enacted, That if the grantee or assignee of any Letters Patent shall suspect any person or persons of infringing the same, it shall be lawful for such grantee or assignee, whether any action or suit at law or in equity shall or shall not have been previously brought, or shall or shall not be then pending, to apply *exparte* to any one of the Judges of his Majesty's Court of King's Bench, Common Pleas, and Exchequer, in chambers; and if such Judge shall be satisfied, by the oath or solemn declaration of the applicant or other credible persons or persons, that sufficient ground exists for such suspicion, and shall see sufficient reason for granting such application, it shall belawfu for such Judge to make an order that the factory, shop, dwelling-house, or other place belonging to the party who shall be so suspected of infringing, or to any other person or persons where such infringement shall be suspected or believed to be carried on, shall be inspected by one or more engineer or engineers, or other fit and competent person or persons (to be approved of by such Judge),

for the purpose of ascertaining whether any such infringement is there carried on; and that such engineer or engineers, or other person or persons, shall be and is and are hereby authorised to enter such factory, shop, dwelling-house, or other place where such infringement is supposed to be carried on, and to give full effect to such order of inspection as fully and absolutely as if such inspection had been ordered or directed by one of his Majesty's courts of law or equity at Westminster, in an action or suit commenced and pending in such court of law or equity.

Provided always, and be it further enacted, That it shall be lawful for such Judge, if he shall think fit, to order and direct that such engineer or engineers, or other person or persons so to be authorised by him, shall be accompanied on the occasion of such inspection by the under-sheriff of the county or city in which such inspection shall be ordered to be made, or by such other person or persons as such Judge shall think proper; and any person or persons refusing to permit or obstructing the execution of such order, shall be dealt with in the same manner as for a contempt of an order of a court of law or equity at Westminster.

And be it further enacted, That the costs of the application for such order of inspection and of carrying the same into effect, shall be borne and paid by the party or parties applying for the same: provided always, That in case any action at law or suit in equity shall be then pending or shall thereafter be brought, commenced, or prosecuted, and a verdict or degree shall be given or made against the party or parties so suspected of infringing such Letters Patent, it shall be lawful for the Judge before whom such action or suit shall be tried or heard, to order and direct that such costs, or any part thereof, shall be paid by the party or parties against whom such verdict or decree shall be given or made, or to make such other order respecting such costs as he shall think fit.

And be it enacted, That in case of an application to his Majesty's Privy Council for the prolongation of the term of any Letters Patent under and by virtue of the said recited Act of the fifth and sixth years of his present Majesty, and upon the report to his Majesty of the Judicial Committee of the Privy Council in favour of such petition, his Majesty is hereby authorised and empowered, if he shall think fit, to grant new Letters Patent for a term not exceeding fourteen years after the expiration of the first term, any law, custom, or usage to the contrary notwithstanding; provided that no such extension shall be granted if the application by petition shall not be made and prosecuted with effect before the expiration of the term originally granted in such Letters Patent.

And be it enacted, That in any action brought against any person for infringing any Letters Patent, the defendant on pleading thereto shall give to the plaintiff, and in every *scire facias* to repeal such Letters Patent, the plaintiff shall file with his declaration a notice of any objections on which he means to rely at the trial of such action, and no objection shall be allowed to be made on behalf of such defendant or plaintiff respectively at such trial unless he shall prove the notice of such objection: provided always, That it shall and may be lawful for any Judge at chambers, on summons served by such defendant or plaintiff on such plaintiff or defendant respectively, to show cause why he should not be allowed to offer other objections whereof notice shall not have been given as aforesaid, to give leave to offer such objections on such terms as to such Judge shall seem meet.

And whereas it is expedient for the greater encouragement of the useful arts and manufactures in these realms to afford some further protection and assistance to the inventors of new and useful improvements, by vesting the property therein in the inventors or proprietors thereof for a limited time; be it therefore enacted, That from and after the one thousand eight hundred and thirty any person who shall invent, design, or contrive, or shall become the proprietor of any invention, design, or contrivance, whereby, in the opinion of such inventor, designer, contriver, or proprietor, some new and beneficial operation or result shall be obtained in any art, science, manufacture, or calling whatsoever, shall, from and after the said have the sole right and property in every such new invention, design, or contrivance for and during the term of twelve calendar months from the time of registering the same as hereinafter mentioned: provided always, That every such inventor, designer, contriver, or proprietor, as shall be desirous of availing himself of the provisions of this Act, shall deposit, or cause to be deposited, in the manner and under the regulations hereinafter set forth, a full, true, correct, and perfect fac-simile, model, or specimen of his said invention, design, or contrivance, with the name and actual place of address of such inventor, designer, contriver, or proprietor attached thereto, in such manner as to the Commissioners or Registrars hereinafter named shall seem expedient, and shall also pay the sum of money in the manner and at the time hereinafter in that behalf mentioned.

And be it further enacted, That it shall

be lawful for his Majesty, his heirs and successors, under his or their royal sign-manual, from time to time to appoint any number not exceeding three Commissioners or Registrars to carry into effect the provisions of this Act, which officers so from time to time appointed shall hold their respective offices during good behaviour, notwithstanding the demise of his Majesty or any of his heirs or successors: provided always, That it shall be lawful for his Majesty, his heirs and successors, to remove any of such officers upon some sufficient reason being found and assigned for such removal.

And be it enacted, That the said Registrars shall as soon as conveniently may be after the said approve of and provide some fit and proper place for the reception of all such fac-similes, models or specimens as shall thereafter be deposited in their custody under the provisions of this Act, and shall cause the same to be preserved and exposed to public inspection in as perfect and commodious a manner, and under such rules, regulations, charges, and expenses, as to the said Registrars shall seem fitting and expedient, during the space of twelve calendar months from the time of the deposit thereof respectively, and shall also be entitled to demand from each person who shall be desirous of depositing such fac-simile, model, or specimen under the provisions of this Act, at the time of such deposit, the sum of ten pounds sterling only; and shall also on receipt of such fac-simile, model, or specimen, and of the said sum of ten pounds, give to every such person who shall require or demand the same a certificate of license, to be signed by one or more of the said Registrars, certifying the date of such deposit, together with a general outline or description of such fac-simile, model, or specimen, to which the same shall relate: provided always, That the said Registrars shall be entitled to demand for every such certificate the sum of one shilling only.

And be it enacted, That if any other person whatsoever after the said shall at any time during the continuance of the said term of twelve calendar months, bearing date from the day of the deposit of such fac-simile, model, or specimen, either directly or indirectly make, use, vend, or put in practice, or in anywise imitate, counterfeit, or resemble the several inventions, designs, or contrivances, to which the same shall respectively refer, or shall make or cause to be made any addition thereto or subtraction from the same, whereby to pretend himself or themselves the inventor or inventors, designer or designers, contriver or contrivers thereof, without the license or consent in writing of the said person or persons whose name or names shall appear on the said fac-simile, model, or specimen relating thereto, and deposited as aforesaid, and also in the said certificate of license, or his or their assigns; or if any person shall, upon such thing not having been purchased from the person or persons named in such certificate, or his or their assigns, or not having the license or consent in writing of such person or persons, or his or their assigns, write, paint, print, mould, cast, carve, engrave, stamp, or otherwise mark the word "Licensed," or "By the King's License," or any words of the like kind, meaning or import, or with a view of imitating or counterfeiting the stamp, mark or other device of the person or persons so having obtained such certificate of license as aforesaid, or shall in any other manner imitate or counterfeit the stump or mark or other device of such person or persons, he shall for every such offence be liable to a penalty of fifty pounds, to be recovered by action of debt, bill plaint, process, or information in any of his Majesty's courts of record at Westminster, or in Ireland, or in the court of session in Scotland, to any person who shall sue for the same: provided always, That nothing herein contained shall be construed to extend to subject any person to any penalty in respect of stamping, or in any way marking the words "Licensed," or "By the King's License," upon any thing made for the sole vending of which a certificate of license before obtained shall have expired: and provided always, That nothing herein contained shall be construed to exempt any person or persons who shall hereafter take advantage of the provisions of this Act from any liability to whith he or they may subject himself or themselves in any action, suit, or other proceeding to which they are now or may hereafter become subject by reason of any infringement or alleged infringement of any invention or contrivance for which his Majesty's royal Letters Patent have been already or may hereafter be obtained: and provided also, That no invention, model, or contrivance for which a certificate of license shall have been granted under the provisions of this Act shall be capable of being made the subject of Letters Patent thereof at any time after the date of such certificate, nor shall the same be capable of being made the subject of a second license thereof under the provisions of this Act.

And be it enacted, That it shall be lawful for the said Registrars for the time being to be appointed under the authority of this Act to receive and take the said sums of ten pounds each on every such fac-simile, model, or specimen as shall be deposited in their custody under the provisions of this Act; and

also the said sum of one shilling on every such certificate of license as aforesaid; and also such sums of money as shall be received in respect of fees of admission to the public for the inspection of the several fac-similes, models, and specimens, and to apply the amount to be so received by them in payment of such necessary expenses as shall be by them incurred in arranging, preserving, and exposing to public view the several fac-similes, models, and specimens, and account for and pay the surplus thereof at such times and in such manner as to the Lords Commissioners of his Majesty's treasury for the time being shall seem fit.

[The second reading of this Bill is fixed for Wednesday, the 20th inst. We shall offer some remarks upon it in our next.—ED. M.M.]

CORNISH HIGH-PRESSURE EXPANDING-ENGINE.

Sir,—As I receive the *Mechanics' Magazine* at the end of each month, I have only just observed a letter in No. 669 from an engineer, Mr. Dickson, impugning in the usual manner the duty of the Cornish high-pressure expanding-engines employed in the mines. The extraordinary incorrectness with which every observation in No. 661 is re-stated, probably may be attributed to carelessness: it is a common mode of evading difficulties, but in all cases demands the strongest reprobation: even the trivial point of the editor's statement, that Cornwall *was* the nursery of steam-engines, is changed from the past to the present time. The following perversion of the statement made, and the party by whom it was made, is scarcely credible. The editor remarks that "the preceding extract, is introductory to a set of tables by Mr. Enys relative to the properties and application of steam:" these tables having been evidently drawn up to prove, as far as practicable, the coincidence of theory and Cornish practice, and that high steam used expansively is the chief cause of the great increase of duty. Now the words in the Polytechnic Report are, "PART of the increase of duty must be attributed to the improved pit-work; the most rapid increase, however, took place on the introduction of a complete system of clothing." How these words became changed into the following—" because, it is stated, that the increase is owing to the improved pit-work, and the system of clothing or casing the cylinders. I am glad the Cornish engineers have give the cause of the great increase, and that it has been accomplished by such simple means"—Mr. Dickson alone can answer; and further, why such observations were attributed to the Cornish engineers, when the name of the writer of the paper was inserted in the *Mechanics' Magazine?* My attention was directed to this subject by Mr. John Taylor's paper in No. 5, I believe, of the *Miners' Review;* in which, from an examination of the mining account books of Dolcoath near Camborne, and also the mines now known as the Consolidated Mines in Gwennap, he proved, by a comparison of two different years with a considerable intervening period, that the quantity of coal paid for by each mine respectively, was found to have decreased in the exact inverse ratio of the reported increase of duty. The water delivered was assumed to have been the same in both years, though Dolcoath had been constantly worked; and from the extension of the levels, and greater depth of the sumps, the water *might* have increased, most assuredly, not lessened, at the later period. The workings at Consols had also been much extended during the intervening period between the selected years, though some part of it had been stopped, or only partially worked. The evidence of the mining accounts must be first successfully impugned before this fact can be neglected. Mr. Dickson's protest against *calculated* duty, is, I suspect, equally applicable to the thirty-two millions duty of Watt's best engines. My belief, I repeat, that both are calculated by the same mode, admitting readily that both are subject to the same well-known error of a result higher than the actual delivery of water; and, further, that the average of the ten or dozen of the best Cornish engines, about 70,000,000 rests on quite as good authority as the thirty-two millions of Watt's engines.

A recommendation appeared in another part of my paper, in the Polytechnic Report, that the difference between the computed and actual delivery of water should be ascertained. From my own knowledge I can state, that the Cornish engineers in no way shrink from ascertaining it, or perhaps, more properly speaking, allowing it to be ascertained; but I must own they regard with the utmost apathy the opinions or assertions

of engineers of other parts of the kingdom.

The difficulty of measuring water taken up from so many different levels, and delivered at the adit, a cramped wet hole from 10 to 40 fathoms under ground, are greater than seem to be anticipated.

At Wheal Darlington, however, near Penzance, which mine is only three feet above high-water mark, the water is raised to the upper floor of the engine-house from a depth of 80 or 90 fathoms, and used for turning a water-wheel with a dozen or more stamps. The usual liberal offer of a trial has been made to me, and perhaps it may be soon accepted. From the joke about jacketting, I much doubt if the "people in the north-east are up" to clothing—meaning by that term any thing equivalent to Watt's straw ropes and lath and plaster; as, for instance, 4½-inch brickwork round the cylinder, surrounded by 10 inches of sawdust in a case of 1½-inch deal battens (painted oak in the smaller engines), 2½ feet of cinders over the boilers, &c. The opinions of the "parties who well know what is going on in Cornwall," are at variance with those of several engineers and pitmen; and the public may place confidence in whichever party they may choose. Mr. Dickson speaks of his experience and belief of fifty millions, and a little further. When; where; and by what sort of engine would be more satisfactory. Those used in Cornwall are the realisation of the proposals in Watt's well-known patent, in which six schemes for equalising the expansive action are mentioned; a point not only unnecessary, but actually injurious in a pumping-engine. No Cornish engineer will attempt to grind four bushels of wheat with the fuel required to grind one in Watt's engine—being aware expansion cannot be carried much, if at all, beyond three times; when the engine acts with a rotative motion against an uniform resistance, he would be satisfied with double duty, coinciding with the theoretical advantage of expansion; and this Mr. Dickson knew, or ought, as an engineer, to have known when he suggested the corn-grinding trial. Perhaps lifting stamp-heads would afford a more accurate criterion of "work performed in pounds one foot high." No error can arise in this case except from improper feeding of the ore to be stamped; and for this a person independent of the engineer always is responsible. 44,435,167 is the duty reported in May by the new stamping-engine at the Charlestown Mines, erected by Mr. James Sims, of Chacewater.

Two similar engines are soon expected to be at work—one at Wheal Kitty, the other at the Carn-Brea Mines. The late increase in stamping-duty is nearly 20 millions. The effect of the steam-engine competition is well-known from the result of the contest on the Manchester and Liverpool Railway. A similar competition has been silently at work in Cornwall for more than twenty years, and the results are equally remarkable.

I must now apologise for so long a letter. Fair play only is asked for the Cornish engineers. I conceive it is for others to disprove the propriety of their following the method used by Smeaton, and introduced into Cornwall by Watt.

I remain, &c.

JOHN S. ENYS.

Enys, July 4, 1836.

ON THE USE OF PIPE-CLAY IN WASHING.

Sir,—I take this opportunity of observing, in respect to the use of pipe-clay in washing, as noticed in the extract from a Dundee paper, at p. 80 in your 665th Number, that the discovery is by no means a new one.

The detergent properties of pipe-clay, fullers-earth, and other saponaceous clays, have been long known and taken advantage of, both in domestic economy and in various manufacturing processes. In the army, and in the navy in particular, pipe-clay has been long and extensively employed in washing and whitening of wearing apparel, and is well known to increase the effect, and reduce the quantity of soap and labour necessary to produce the effect required; although the actual saving of both is somewhat overrated in the article quoted as above.

There is no question but that a more extensive diffusion of a correct knowledge of the real properties of these substances, which are in many places exceedingly abundant, will tend to produce increased

economy in the application of two costly materials—soap and labour.

I remain yours respectfully,

W. BADDELEY.

Birmingham, June 27, 1836.

ELECTRIC CURRENTS.

At a late meeting of the Royal Society a paper was read "On the reciprocal attractions of positive and negative Electric Currents, whereby the motion of each is alternately accelerated and retarded," by P. Cunningham, Esq., Surgeon, R. N., communicated by Alexander Copland Hutchison, Esq. The following abstract of which we quote from the *Athenæum*:—

"The author found that a square plate of copper, six inches in diameter, placed vertically in the plane of the magnetic meridian, and connected with a voltaic battery by means of wires soldered to the middle of two opposite sides of the plate, exhibited magnetic polarities on its two surfaces, indicative of the passage of transverse and spiral electrical currents, at right angles to the straight lines joining the ends of the wires. The polarities were of opposite kinds on each side of this middle line, in each surface; and were reversed on the other surface of the plate. The intensities of these polarities at every point of the surface were greatest the greater its distance from the middle line, where the plate exhibited no magnetic action. The author infers from this and other experiments of a similar kind, that each electric current is subject, during its transverse motion, to alterations of acceleration and retardation, the positive current on one side of the plate, and the negative on the other, by their reciprocal attractions, progressively accelerating each other's motions, as they approach, in opposite directions, the edge round which they have to turn. After turning round the edge their motion will, he conceives, be checked, by coming in contact with the accelerated portions of the opposing currents to which they respectively owed their former increase of velocity; so that the one current will be retarded at the part of the plate where the other is accelerated. To these alternate accelerations and retardations of electric currents during their progressive motion, the author is disposed to refer the alternate dark and luminous divisions in a platina wire heated by electricity, as was observed by Dr. Barker."

PATENT ROTARY PRINTING-APPARATUS.

A patent has recently been taken out by Mr. Rowland Hill for a rotary printing-machine. The types are imposed* upon cylinders, to which they are firmly attached, and of which, except the marginal spaces, they occupy the whole surface. The pressure is given by blanket-covered cylinders of the ordinary construction.

The most important advantages of this arrangement are stated to be, first, That as the revolving type cylinder is constantly receiving its ink in one part of its revolution, and constantly impressing the paper in another part, the action of the machine is unceasing; whereby a saving of time of about three parts out of four is obtained in comparison with the ordinary printing machines, when moving at the same velocity; because in those machines the backward motion of the form,* and the laying on of the ink, suspend for the time the process of printing. Further, as the motion of the type in this machine is continuous instead of reciprocating, the speed has been increased without difficulty or danger; and by this additional velocity, combined with the saving of time just described, the rate of printing is brought to about ten times that of the ordinary perfecting machines, i. e. those which print the sheet on both sides before it leaves the machine. Secondly, the reciprocating motion of the heavy form, inking table, and inking rollers of the ordinary machine entails such a loss of power and time, in comparison of the rotatory motion which is here substituted for it, that it is believed, from careful observation, that, notwithstanding the great increase in speed, any given quantity of work will be executed at the expense of about one-eighth of the power required in the ordinary machine.

The facilities provided for fixing the type, detaching parts for correction, applying the ink and regulating its supply, are said to be fully equal, if not superior, to those of other machines.

Compared with the rapid machines used for printing the daily newspapers, the rotatory machine will print two sheets on *both* sides with accurate register, while they print *one* sheet on one side with defective register.

NOTES AND NOTICES.

We learn, that the manufacturers of pig-iron in Scotland have come to the resolution of stopping one-half of their smelting furnaces almost immediately. The reason for their so doing is the demands of the colliers for a further advance of wages. The present high price of iron will, therefore, in all probability, be maintained for some time to come.—*Glasgow Chronicle.*

Electrical Experiment.—A salad, consisting of mustard and cress, may be produced in a few minutes by an electric experiment. The process is to immerse the seed for a few days previously in diluted oxymuriatic acid, then sow it in a very

* These words are used technically.

light so l, le'ting it be covered with a metallic cover, and next bring it in contact with the electric machine. By the sam· agents employed in this process, eggs which require from nineteen to twenty-one days' application of animal heat to hatch them, may be hatched in a few hou s. Rain water, apparently free from any noxious animalcula, in an hour can be rendered full of living insects. Water, in a short period decomposed of its two component parts, oxygen an hydrogen, and by the same power resto ed to its former state; and platina, the most difficu t of al metals to melt, in a moment can be fused and calcined by the discharge of an electric battery. An iron bar, by the discharge of a sufficient accumulation of the electric fluid, will become magnetic to such a degree as to lift more than its own weight; and if a pound of red lead and a pound of sulphur be mixed together into a mass, which no human ingenuity can separa e, a str. am of the electric fluid will do it at once.—*Cambrian.*

Ingenious Piece of Mechanism.—A very ingenious piece of mechanism, a miniature steam engine, has been constructed by Mr. Richard C rfield, a young man in the employment of Messrs. Gittins and Cartwright, at the Eagle Found y, Shrewsbury. It consists of an engine not exceeding an half inch cylinder, for the purpose of propelling a steam-boat, working its propelling shaft at the enormous speed of five hundred and fifty r volut ons per minute—travelling a distance of thirty miles in one hour. The oiler is so constructed as to admit a spirit-lamp in the centre of the water, which affords sufficient fu l and steam for one hou. We should add, that the above is only one of many extraordinary specimens o useful, thou h mi iature and elaborate, works of art made by Mr. Corn l .—*Ibid.*

Berlin Iron Ornaments.—Some of these are so fine, consisting of rosettes, medallions, &c., hat nearly ten thousand go to the pound. In the coarse fabrics the value of the materi l is increased by manufacturing eleven hundred tim s, and in the finer nearly ten thousand tim s.—*Arcana of Science,* 1835.

The Quadrant.—In 1731 it was said, "as soon as the common prejudice against new things is worn off, and the instr men is well known, I do not believe any ship will go on a long voyage without one of these excellent quadrants."

A French Mechanic.—M. Cavi was brought up a joiner. Aft r serving n the army (what Frenchman is not a soldier?) he returned to Paris with a capital of 50 *cents.* He worked with a pattern maker during the day, and in the evening took lessons in drawing, and as much of th night as could be spared from sleep worked upon the plans commenced in the drawing school. In 1823, he undertook the manufacture, in a small way, of steam-engines, and in eight years had become possessed of stock in trade to the amount of on thousand dollars. After losing two-fift s of t is by the failure o an individual connected in the way of business with him, he s cceeded in recovering himself so far hat in ten years he ha manufactured 123 steam-engines, the total nomi al power being 2,835 hors s. He has ma le recently an iron steam-boat, naviga ing the lakes Neuchatel, Thorum, &c. His present establishment en bles him to furnish a steam-eng ne of 160 horse-power in a mon h.—*Baron Dupin.*

Busts.—A new instrument has been invented in Paris called the physionotype, for the moulding of busts, on a principle which renders the likeness to the original a mecha ic ce t inty. Busts in plaster re thus pr duced for five francs each. Another machine, entitled the portrait mirror, has also been constructed, y which a portrait ..ay be taken in twenty minutes fro the reflection of the face of the original in a looking-glass.—*Athenæum.*

State of the Arts in France.—There are in France, at the present moment, 82 museums; 160 public schools for the advancement of the fine arts; 2231 exhibiting artists, viz. 1096 ainters; 150 sculptors; 113 engravers; 253 architects; 309 painters in water-colours and draftsmen; in all 1385 artists. Besides the institutions above enumerated, there are societies for the encouragement of art, and exhibitors of modern pictures, in all the principal provincial towns in France. The five departments, which are the richest in artists, and in art after that of the Seine, are those of the North, the Gironde, the Rhone, the Lower Seine, and the Seine-cum-Oise. There is scarcely a town of any importance throughout France that does not boast of its annual exhibitions of modern pictures, its societies for the encouragement of art, and its honorary and substantial rewards for artists.—*Athenæum.*

Communications received from Mr. Noad—Mr. Baddeley—Mr. Dyke—Pig Iron.

Errata.—No. 672, p. 202, col. 2, 6th line from bottom, after "arse ious" read "acid."

P. 2 3, col. 1, 26th ine from top, for "bichroniate" read "bichromate."

Do. 14th line from bottom, for "as" read "was."

Do. col. 2, 25th line from top, for "these" read "there."

Do. do. 33rd line from top, insert ";" after the word "down."

Do. do. 6th line from bottom, for "seeme" read "seems;" 7th line from he bottom, for "arsenic of silver" read "arsenite of silver."

Do. do. 18th line from the bottom, for "pressure" read "presence."

P. 204, col. 1, 32nd line from top, for "alkal" read "alkali."

In the Tables relative to the Property of Steam, No. 661, *p.* 4.—In Tab e 1, the pounds pressure per sq are inch opposite 3·75 atmospheres ought to be 55 3215 instead of 55·125.

Table 2. Expansion 1·5, density in pounds per square i ch at the termination of the stroke ought to be 10 5 instead of 15·5.

Ta le 3. For 17lbs. steam pressure, it should be a volum of 1497 instead of 1417, which last volume belongs to the n xt, or 18lbs. steam pressure in the same table. Advantage of steam worked expansively last row, should be 3,313 instead of 3,133.

In a few impressions of our last week's Number, p. 242, col. 2, line 28 from bottom, for "full size" rea "3 7 hs of the full size."

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C. E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

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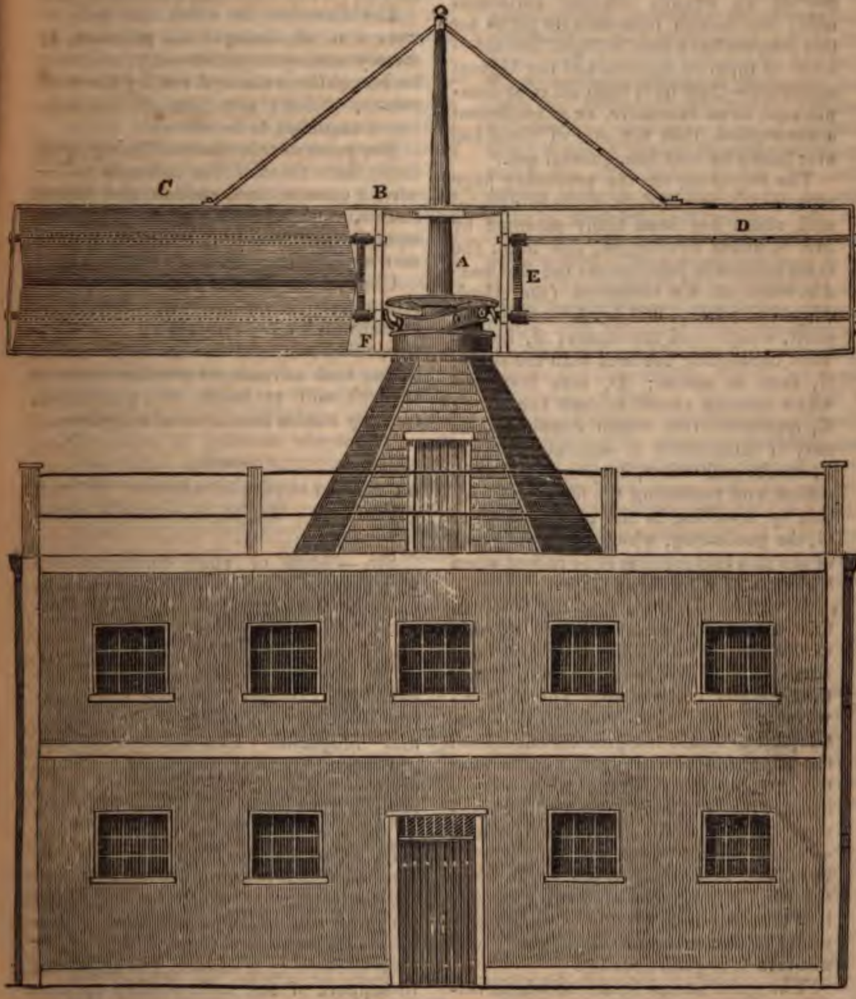
SYMINGTON'S PATENT HORIZONTAL WINDMILL.



retarded its progress in no small degree. In treating of electricity as a science generally, comprehending electricity, properly so called, galvanism, magnetism, and electro-magnetism, it has been usual to allot the first place to electricity, and to refer the analogies that might arise in the course of investigation to that head, as being the root or parent stem of the general science. This arrangement has been established by the accidental order in which the several branches have been discovered. The highest place has been assigned to that which lays claim to priority in this respect, and concerning the principles of which it was conceived some definite conclusions had been formed, when the more recently discovered branches presented themselves to our notice. In tracing the connexion subsisting between the several branches, considerable facilities were no doubt afforded to the early experimenters by considering them in this order; but the connexion being now clearly established, this, which may be called the inverted order, is no longer required. However trivial and indifferent this distinction may appear at first view, a little attention to the nature of the subject will convince us, that in this, as in all other sciences, a proper and *natural* arrangement is of the utmost importance, and enables us to lay hold of, and examine the subject under consideration in a more clear and comprehensive manner. In the present case to begin with galvanism, may be familiarly expressed as beginning at the right end. In the galvanic circle electricity is evolved by a process of nature; whereas by the electric machine the means employed are strictly artificial, and the result appears to be a mere mechanical separation of the two principles, designated, according to the doctrine of Du Fay, the vitreous and resinous electricities. There cannot be a doubt that galvanic action is constantly and universally operating throughout the whole material world. Wherever there is moisture in combination with more solid materials, it appears certain that galvanic effects are determined. And that it is intimately connected with the vegetative process appears unquestionable, and has been ably elucidated by the very satisfactory experiments of Mr. Pine, of Maidstone, and his friend, Mr. Weekes. It would thus appear, that *in all the natural processes* of the mineral *and vegetable kingdom* galvanic electricity is continually evolved, and opposing electrical conditions for ever induced.

It must be allowed that, upon a philosophical examination of the varied phenomena presented in the course of electrical experiments, neither of the two existing theories of Franklin or Du Fay furnish satisfactory solutions for all the appearances induced in electrified bodies. From a feeling of their insufficiency, and with a view to verify the one and explode the other, experiments were instituted and prosecuted for some time with indifferent success; in the course of which a suspicion was awakened that electricity is rarely, if ever, evolved or found to exist in the condition of a simple element, either in the earth or in the atmosphere, or, in short, in any state whatever; that even in its passage from one solid to another it carries along with it in combination a secondary fluid of a subtle character, which serves as a base for its transmission—and that the species of electricity, as vitreous or resinous, is determined by the character of the base with which it is incorporated. M. Augustus de la Rive seems to have arrived at a conclusion of a somewhat similar nature. He found that voltaic electricity, in passing out of one conducting body into another of a different kind, always sustains some loss of its intensity, which he ascribes to a process of *filtration,* by which certain parts of the fluid are deposited during its passage through the conducting body. "The phenomena," he states, "correspond to those which would take place if we could imagine that there were two distinct kinds of electric current, the one capable of passing indiscriminately through all sorts of conductors, good or bad—the other capable of passing through good conductors alone. The passage of the currents through successive plates gradually effect the separation of these two portions; the plates arresting the one which cannot pass so readily through bad conductors, and giving free passage to the other portion." The experiments above alluded to were conducted upon a principle differing in several respects from those of M. de la Rive, and the results obtained were of a more decided character. It was conseived that sufficient indications had been obtained to warrant the construction of a new theory, which, it will be perceived, partakes in some measure of the nature of both the former. In this theory the two

electricities are distinguished from each other by the character of the bases with which they are combined. It assumes,

1st. That there exists in all bodies a subtle homogenous fluid called the electric fluid.

2nd. That there are two secondary fluids, which may be termed the vitreous and resinous bases with which the electric fluid is found at all times to exist in combination.

3rd. If a cylinder of smooth glass is excited by friction, electricity is obtained in combination with the vitreous base.

4th. If a cylinder of sealing-wax is excited, electricity is obtained in combination with the resinous base.

5th. Two bodies charged with the vitreous compound repel each other.

6th. Two bodies charged with the resinous compound repel each other.

7th. Two bodies, the one charged with the vitreous and the other with the resinous compound, attract each other.

The experiments from which the above were deduced, were conducted upon a scale too limited to entitle them to implicit acceptation, although the indications were as decided as could be anticipated from the nature of the subject, so far as they were prosecuted. They will probably be resumed at an early opportunity, when the details will be laid before the readers of the *Mechanics' Magazine.* Proceeding upon the above data, the following conclusions were deduced with respect to the theory of the universe.

That in consequence of galvanic action operating universally within the earth, a continuous stream of electricity, in combination with the resinous base, is evolved and given out through the pointed extremities of vegetables, and from the surface generally, its intensity varying at different seasons and from different natural causes. That this stream is taken up by, and finds a conductor in, an opposite current of electricity, in combination with the vitreous base that is continuously issuing from the sun; and that, in all probability, light is merely an effect produced by an infinity of coruscations generated by the rapid transmission of the currents through each other. The diverging rays of the two currents being refracted by their mutual attractions, according to the known laws of electricity, are thereby concentrated, and cause an accumulated supply of light in the earth's immediate vicinity, and that to this concentration of light the silvery shining appearance of the moon and planets is principally to be attributed. That in operating the vegetative and other processes, in which its influence is essential, the vitreous base of the solar current is fixed, and the electric fluid being disengaged, instantly combines with a portion of the resinous base which has been necessarily converted from a latent to an active state at the same time, and thus the attractive and repulsive conditions of the electric fluid being reversed, it is again attracted towards the sun from whence it has been derived. In this manner, by the reciprocal interchange of the two bases, the earth is slowly and gradually undergoing a transmutation in her electrical properties and conditions, by which the repulsive force between the sun and earth is weakened, and the latter consequently drawn nearer to the centre; thus, by the action of the two currents, a stimulating and salutary circulation is kept up throughout the solar system, upon the activity of which the fructifying power of different seasons principally depend, and thus also is the earth relieved of a fluid as the animal body is relieved of the insensible perspiration, which, having effected the purposes for which it was destined in the vegetable and mineral kingdoms, would, if retained, produce stagnation and derangement throughout the whole economy of the earth.

To enter into all the arguments and analogies that seem to reflect credibility on the foregoing conclusions, would fill a volume. We must therefore, at present, content ourselves with presenting a few instances from which they appear to derive support.

That light is essential to vegetation, is known to us as a matter of fact, and that the shoots and leaves of vegetables are invariably attracted towards the sun, is equally well established by the experience of every individual whose botanical knowledge is of sufficient extent to enable him to plant and rear a geranium or a rose in his parlour window. Vegetables which have been reared in the open air will fade and become pale in a few hours if deprived of the light of the sun, and will eventually perish, whatever care may be taken to preserve them. It is also known, that solar light favours the assimilation of carbonic acid in vegetables, and aids, in an essential manner, the

formation of the aromatic and volatile principles, and is so essentially necessary to flowering and fructification, that ripe seeds have never been obtained from plants excluded from its influence. In proof of the connexion between electricity and vegetation, the reader is referred to the papers of Mr. Pine, which will be found in 639, 669, and other Numbers of the *Mechanics' Magazine*. Some of Mr. Pine's experiments appear to possess all the certainty of mathematical demonstration.

That light emanates from the sun, thereby forming a *material* connexion between the earth and that body, is admitted. It therefore remains to trace the connexion between light and electricity. It has been observed, that "electrical light differs in no respect from light obtained from other sources. Dr. Wollaston found, that when observed through a prism, the ordinary colours, arising from the decomposition of light, are obtained; but the prevailing tint of colour will vary according to the different substances through which the sparks pass, or to the nature of the surface from which they emanate, or by which they are received. Dr. Brewster found that it is capable of undergoing polarisation, either by transmission through a doubly refracting crystal, by reflection at the proper polarising angle from a polished plain surface, or by oblique refraction through a series of glass plates." That light, possessing all the characteristics of solar light, may be obtained by the action of two opposing currents of electricity, has been verified by experiment with the galvanic battery. "The most splendid exhibition of electric light is that obtained by placing pieces of charcoal shaped like a pencil at the ends of the two wires in the interrupted circuit, and bringing their points into contact. When the experiment was tried with the powerful battery of the Royal Institution, a bright spark passed between the two points of charcoal, and immediately afterwards more than half of each pencil became ignited to whiteness. By withdrawing the points from each other, a constant discharge took place through the heated air in a space equal to at least four inches, forming an arch of light in the form of a double cone of considerable breadth, and of the most dazzling brilliancy. The light obtained by voltaic electricity, in the manner now described, exceeds in intensity any other that art can produce. It often exhibits in succession a variety of the prismatic colours, and supplies some of the rays which are deficient in the solar beams. It is a light which so nearly emulates the brightness of the sun's rays, as to be applicable for the purpose of illuminating objects in a solar microscope."

Those readers who may feel desirous of pursuing the subject, are referred to an article in *Chambers's Edinburgh Journal*, No. 208, on electricity, as connected with light, heat, galvanism, and magnetism, which will be found well worthy perusal. The silvery shining aspect of the moon and planets strongly supports that view which supposes light to be generated by the action of two opposing currents passing between the sun and planetary bodies; if we suppose that light is not generated in this manner, but issues from the sun in full possession of all its illuminating properties, we might expect that some traces of a luminous nature would be seen in the vault of heaven through an unclouded atmosphere, even in the darkest nights of winter. We know that such is not the case, but at those times we may see the planets shining with a brilliancy so clear and translucent, that we cannot conceive it to result from the reflection of the sun's rays from mere earthy matter. Astronomers have been much perplexed in their endeavours to explain the cause of the brilliant appearance of the moon and planets, and it is presumed, that by adopting the hypothesis, which suppose the production of light by the action of two electrical currents between the sun and planets, much of the difficulty would be obviated.

With regard to the phenomena of the thunder-storm, and the electrical conditions of the atmosphere, the explanations given are the most confused and unsatisfactory that can be imagined: one author informs us, "that the peculiar matter known under the form of electric fluid seems to pervade all nature, it constantly seeks an equal distribution, and some bodies conduct it with more facility than others. Of this remarkable fluid the earth is the great reservoir, and when an equilibrium exists between it and atmospherical bodies, no sensible phenomena takes place; water is a better conductor than air, for which reason, during a thick fog, when the earth is surcharged with electrical matter, the electricity is con-

ducted away without any sensible effects, but if the air remain dry, as it often is during the summer and autumn months, then the fluid, instead of being conducted gently, *forces itself through the intervening space to the* ATTRACTING BODY, *and produces loud explosions*." By another, and not unfrequently by the same author, we are told, "that clouds are attracted by mountains. Every cloud is charged with more or less electricity, and the mountains which rise high in the atmosphere act as attractions. When the cloud approaches, being in an opposite electrical state, the mountain abstracts from it a portion of its electric fluid, in consequence of which the watery vesicles collapse and fall in rain drops." The explanations given of the other phenomena connected with the thunder-storm, are equally confused and contradictory; but we cannot at present stop to examine them, and those given above are sufficient for our present purpose. Now if it be really the case, that electricity forces itself up through the atmosphere, producing loud explosions, we are compelled to adopt the conclusion, that that portion of the fluid is repelled from the earth, and cannot conceive how the same portion of the fluid can be again attracted towards the earth, unless we suppose that the attractive and repulsive forces have been reversed during its combinations with the atmosphere. The same reasoning applies to that portion which is attracted towards the earth. We cannot imagine how it found its way into the clouds. But if we adopt the hypothesis of the two currents, these contradictory statements, which are probably both correct, may be at once reconciled. When the vitreous fluid is redundant, it will force a passage downwards and upwards when the resinous is redundant. It has been observed, that thunder is more frequent during the latter months of summer and in the autumn, which Mr. Pine accounts for by supposing that the vegetative process of the season being perfected, and the earth saturated with the solar fluid, the electricity not finding a free passage, is accumulated in the atmosphere until it has acquired sufficient power to force a passage; and illustrates and supports his opinion, by showing that vegetable points will draw sparks from the prime conductor at a much greater distance in the spring than in the autumn season.

If we admit that galvanic action is constantly fixing the vitreous or solar base, and liberating the resinous or terrestrial base, the earth's rotary motion follows with as much certainty as the rotation of a wheel loaded with water upon one side and with air on the other. That part of the earth and atmosphere which is setting to the sun being surcharged with the solar base, yet in an active state, is repelled, whilst the part which is rising being surcharged with the terrestrial base in a similarly active state, is attracted; the aggregate quantity of fluid, with which the whole earth is charged, fulfilling the conditions of a fulcrum or pivot to the revolving body. Again, the galvanic action, which is undoubtedly operating within the earth, must, as in all ordinary cases where that action is excited, be constantly tending to a final determination; and, like all other known powers, exhausting itself by its own action, and in proportion, as the action becomes weaker, the vegetating principle becomes weaker, the earth's capacity to absorb the solar fluid becomes weaker, and she is drawn towards the centre of attraction as certainly as a heavy body is attracted down an inclined plane.

It may be proper, however, to remark, that these views are advanced merely hypothetically, that no merit is claimed beyond that of fairly stating the question according to the views entertained. They are presumed to be original in some of their leading features, but are by no means so with regard to the general suspicion of electricity being the primary agent employed in operating the grand purposes of nature. The following intelligent and talented individuals may be referred to among others who have entertained suspicions of a similar character: Dr. Hutton, in his "Mathematical Dictionary," art. Electricity; Dr. Darwin, Dr. Thompson, Mr. Pine, and Colonel Macerone. It may be asked for what purpose was so tremendously powerful an agent as electricity instituted among the elements of nature, or what adequate effects have as yet been by men assigned to its operations. Will it be contended that the Creator, who has made nothing in vain, has not destined it to consummate effects corresponding with the vastness of its power and the unlimited extent of its influence? In every process of nature, with the operation of which

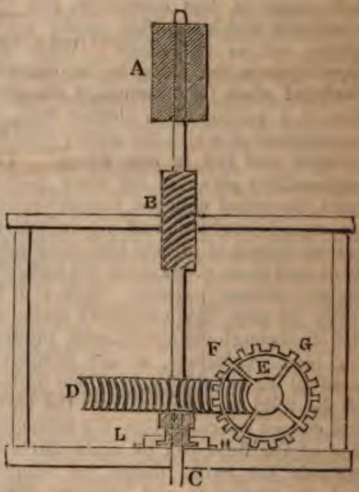
we are acquainted, we find the means nicely adjusted to the end, the cause and effect adequate to each other; and shall we suppose that so vast a power has not effects of a corresponding magnitude to produce; or was this great power instituted for the mere object of amusing philosophical experimenters? In short, to assert that this element is not deputed to operate effects commensurate with its greatness, is to accuse the Creator of imbecility.

Zeta affects to sneer at the hint incidentally thrown out, that Newton should have failed in not tracing the cause of motion to the all-pervading power of electricity. It must be borne in mind, that the doctrine of universal gravitation has been considered by men whose judgments are not to be contemned, as nothing more than a plausible hypothesis, to which they object, "If the centrifugal force alone keeps the moon from approaching the earth, by what force is the earth kept from approaching the moon? And, on the same principle, if the centrifugal force restrains the earth, and prevents her from approaching the sun, what force prevents the sun from approaching the earth, especially when the planets are in conjunction, at which time their united attractions, on the principle of universal gravitation, must draw the sun from the centre and derange the whole system?" In its application to the tides they conceive that they have discovered a paradox, and say, "If we admit that the moon's attraction produces a tide by drawing the surface of the ocean nearer to herself, we cannot understand how this drawing power should cause the surface of the ocean to recede from the moon upon the opposite side of the earth at the same time." With respect to the law, that "if a body be in motion it will continue to move uniformly forward in a right line, if it be not disturbed by the action of some external cause," it is objected that this law, so far from having been demonstrated, is not even capable of demonstration when applied to explain the motions of the heavenly bodies, since no measure of the external resistance can be obtained; that although it may hold when abstractedly considered, abstract principles have not nor ought to have any place in natural philosophy.

Hoping that these observations may be useful, by placing the "Electrical Theory of the Universe" in a more clear and correct point of view,

I remain, Sir,
Your obedient servant,
T. S. MACKINTOSH.

IMPROVEMENTS UPON THE HYDRO-OXYGEN MICROSCOPE.



Sir,—In throwing the flame upon the lime in the hydro-oxygen microscope, it is found that deep cavities are formed in it by the violence of the flame, and that it is requisite to move it to cause the fire to act upon another part, otherwise the light becomes dull and the large lenses endangered. This at present (or was till last year, when I directed the maker to cause it to revolve and rise,) is moved by hand, which is inconvenient in several respects; first, if a hole is made, the radiant point of the lens is altered, and perfect distinctness is gone: the object glasses are endangered, and in opening the door to adjust the lime, a light is thrown into the room. Moreover, one of the cylinders of lime will only last one exhibition, whereas, by being turned regularly, it would do for several. The improvement consists in causing the lime to revolve regularly and slowly, and, at the same time, rise gradually, whereby the same part never comes under the action of the flame twice.

A B C is an upright shaft, upon the

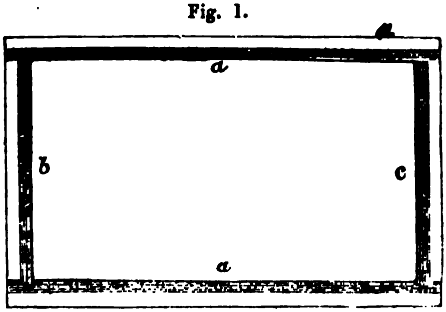
upper end of which the cylinder of lime A is put; D E a grooved wheel to be driven by an endless screw, E, which endless screw has a cogged wheel F G H, which is driven by a spring having a train of wheels, the whole being regulated by a fly. The screw B is for the purpose of raising the shaft A B C when turning. By this screw the shaft A B C is raised; one whole revolution raising it the distance of one thread on the screw; the grooved wheel D E slides freely upon the shaft by a sliding piece K, having a square hole in it fitting the shaft, and which causes the wheel to turn along with it. That the wheel D E may not rise or fall, a groove or slit is made in K, which runs in a piece of board L H, fastened to the lower board.

W. Ettrick.

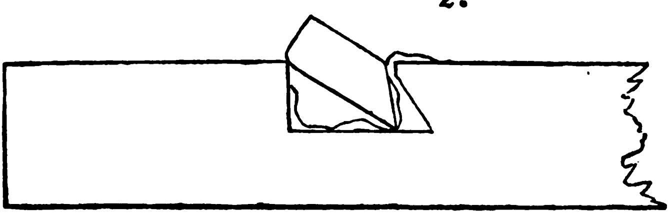
STRAINING DRAWING-PAPERS.

Sir,—Perhaps the following methods of straining paper for drawings, without cements, may be useful to some of your readers:—

Fig. 1.



2.



3.

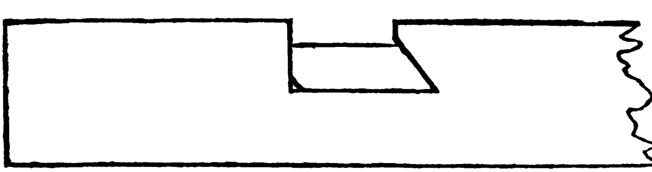
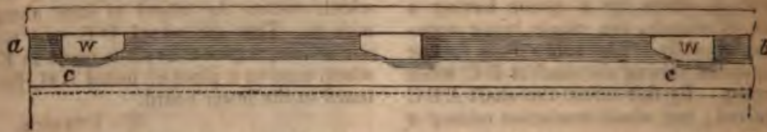


Fig. 1 is a plan of the drawing-board, with four grooves *a b c d* cut round it, in which four slips of wood fit, as shown in fig. 2, which is a section through one of the grooves. The damp paper is to be laid on the board and tucked into the grooves. The slips of wood are then to be put into the position shown at fig. 2, along the whole side at once, and then pressed down into the grooves, as in fig. 3. It will be seen that the more the paper strains the more firmly it will be held.

I have had a board made as above for

antiquarian paper, and find the plan to answer in practice. There is a little difficulty in putting the slips into their places, which may be very much lessened by the grooves and slips being made perfectly straight and parallel; or it may be entirely removed by the following contrivance:—



a b is one of the grooves; *cc*, the slip of wood, much narrower than the groove, so that it can be laid in its place, and forced tight up by the wedges *ww*. The empty parts of the grooves may serve to prevent the instruments rolling off the board.

Yours, &c.,
JAMES HENNELL.

June 4, 1836.

HEATONS' BRICK-MAKING MACHINE.

"Dazzled with the splendid discoveries of science—proud of the almost immeasurable distance at which we have left the man of former ages, in the application of mechanics to the purposes of life—still prouder of the discoverer of that leviathan of modern times, the power of steam—and elevated beyond measure at the rapid creation of wealth which has resulted from this union of individual talent and national industry, we forget, in our delirium of joy, to ask the important question, Whether morality, in the most extended signification of the word, has progressed in the ratio of scientific acquirement?"—R. DETROSIER.

Sir,—I have already (at p. 248 of your 23d volume) had occasion to notice the improved method of tempering clay by rolling, introduced by Messrs. Heaton (brothers), of Birmingham; a practice which has since come into very extensive and successful operation.

Upon a recent visit to Birmingham, I had the pleasure of witnessing the operation of some excellent brick-making machinery, invented by the same ingenious mechanists.

Messrs. Heatons having a steam-engine in constant work, by which the clay was raised from the pit and tempered, found themselves much inconvenienced by the irregularity and uncertainty of their workmen, especially the moulders. The moulding of bricks by hand requires a certain degree of skilled labour, and is paid accordingly; and I doubt not most of your readers know pretty well the general character of workmen of this class—suffice it to say, that Messrs. Heaton created so much disappointment among their connexion, and sustained so much positive loss, through the caprice of the moulders, that they resolved upon calling in the further aid of machinery. The result has been, they have succeeded in producing a machine, exceedingly simple in its construction and operation, and admirably adapted for the purpose to which it is applied.

Mr. Babbage, in his Treatise on the Economy of Machinery and Manufactures, says, "Wherever it is required to produce a great multitude of things, all of exactly the same kind, the proper time has arrived for the construction of tools or machines by which they may be manufactured;" and the formation of bricks is certainly a legitimate object for the employment of machinery.

Messrs. Heatons' machine consists of a large horizontal wheel or revolving table, upon the upper surface of which a number of brass moulds are inserted at regular intervals. At the bottom of each mould is a species of carriage, having motion vertically within the mould; each carriage is supported by a rod, which terminates below in a small grooved wheel. These wheels run upon a circular iron railroad, which dips as it approaches the clay-hopper—the inclination being exactly equal to the thickness of a brick. At one point, beneath which the mould-table revolves, a hopper is placed, into which the tempered clay is led from the rollers. A female sits a short distance on the right of the hopper, and as the table rotates, she places a mould-board in each of the moulds as they come before her. A small forcing-pump, situated between the female and the hopper, injects a quantity of water, sufficient to wet the mould and prevent adhesion of the clay. The table being connected with the steam-engine by a pall and ratchet, it is made to advance with an intermitting motion. When a mould comes under the hopper, the table stops,

and a plunger working in the hopper drives the clay forcibly into the mould—the table then advances one step, and a knife-edge attached to the lower side of the hopper divides the clay, and smooths the upper surface of the brick. As the table continues to revolve, the small wheels ascend the inclined plane, and the bricks are pushed up out of the mould; a man, who is stationed on the left of the hopper, removes the bricks to the barrow, which when filled is wheeled away, and the bricks set to dry, and afterwards burnt, in the usual manner.

The table, force-pump, plunger, &c., are worked by the same steam-engine that tempers the clay; a crank working within a fork gives the required motion to the plunger, and the whole is so beautifully adjusted, that at every step a mould is brought beneath the hopper. At the moment of stopping, the plunger descends and fills the mould—the forcing-pump at the same time washing the mould next in succession.

Messrs. Heatons have effected a considerable saving, by dispensing with the sand hitherto so profusely used in brick-moulding, and which in their locality is very costly; to prevent the bricks from sticking, each of the mould-boards is covered with flannel, which effects the parting most conveniently—and as the durability of the mould-boards thus covered is very great, the expense becomes exceedingly trifling.

In a new table, which Messrs. Heatons are about putting up, they propose to employ a parallel double row of moulds, so that twice the quantity of bricks will be formed with the same number of motions, and in the same time as at present.

In carrying their determination into effect, Messrs. Heatons have been assailed with every species of insult and annoyance. They have been threatened —even with assassination; but all these threats have been disregarded, and all the obstacles so pertinaciously thrown in their way have been triumphantly surmounted, and machinery has now, in these works, effectively superseded the skilled labour of the idle and improvident.

It is much to be regretted, that this is not the only establishment, nor this the only manufacture, in which the ignorant blindness of the workmen to their own interests, causes much injury both to themselves and their employers. There are at the present time several processes of art that might be most advantageously perfected in Birmingham, and other manufacturing towns, which are daily transmitted to London for completion—the punctuality with which work can be there executed being more than sufficient to compensate for the time and expense of carriage, as well as the higher prices charged in town for workmanship!

Oh! that the time had arrived when every artificer should be able to see how intimately his own interest was connected with, and in a great measure dependent upon, that of his employer.

Education's enlightening influence is truly making wide and rapid strides, and producing a great amelioration in the condition of the industrious classes.

The unprecedented increase of deposits in Saving-Banks, the spread of Benefit, and other societies of a similar useful character, throughout the country, may be cited as evidences of the extent of this amelioration; but there still remains an immense mass of the "*old leaven*," the existence of which continually grieves the eyes of the beholders.

I remain, Sir,

Yours respectfully,

WM. BADDELEY.

London, July 12, 1836.

OBSERVATIONS ON THE PHENOMENA OF THE LATE SOLAR ECLIPSE, MAY 15, 1836, MADE AT SANDWICH, IN KENT. LAT. 51° 7′, N., LONG. 1° 18′, E., SEVEN FEET ABOVE THE LEVEL OF THE SEA.

The lovers of the sublime science of astronomy may congratulate themselves on the favourable and almost unparalleled opportunity which occurred, as far as

have been able to ascertain, throughout this kingdom, in giving facility to observers of the grand phenomena attendant on the late annular eclipse of the sun. In submitting my own memoranda to public notice, I will merely remark, that all the observations and experiments were conducted with the greatest possible attention to accuracy, and that I am eminently indebted to the prompt and unremitting efforts of my assistant on the occasion, Mr. F. M. Duncan, whose services were as indispensable as they proved effective, during the whole period of obscuration. The most favourable disposition of atmosphere had for several days preceded the eclipse; and at the moment of its occurrence, the sky was perfectly cloudless and uniformly translucent. Allowing for the difference of longitude, the calculations given in White's "Ephemeris," and several other almanacs, were found in strict accordance with observation.

At the commencement of the eclipse, the barometer stood at thirty inches seventy-two hundredths, continuing stationary until about twenty minutes before the termination; when the mercury had sunk three hundredths of an inch, gentle breezes prevailing from the E. N. E. The following table exhibits the decrease of light and heat, as shown by the photometer and thermometer during the progress of the phenomenon up to the moment of the greatest obscuration. The former instrument is constructed upon the supposition of the usual quantum of light in a bright day being represented by 50°, and the figures in the table exhibit the decrease: the thermometer is graduated to the usual scale of Fahrenheit; and at the moment of contact between the two luminaries, stood at 70° 1h. 57m. 15s.

Time of Observation in		Photometer.	Thermometer.
Hours.	Minutes.		
2	20	47°	
2	30	34	
2	45	29	
3	00	19	
Greatest obscuration . . .		5	
1	57		70°
2	30		66
2	45		64
3	00		60
Greatest obscuration . . .			56

Hence it will be seen, that by the disappearance of the digits eclipsed, 10m. 1-third on the sun's north limb, the light diminished in the proportion of 42 parts in 47, as shown by the photometer from the commencement, while a diminution of 14° degrees of heat is exhibited by the thermometer.

By a remarkable coincidence, one of the finest groupes of solar spots which has appeared for a long time, occupied a great portion of the sun's disc during the whole continuance of the moon's transit, and remained visible with very slight variation during eleven succeeding days. The prefixed sketch, made during the progress of the moon's body across the solar disc presents, as far as outline and relative position are concerned, an accurate representation of these solar maculæ, which assumed an unusually well-defined and striking appearance. The group commenced near the sun's equator, and forming a semi-circular arrangement, terminated near the edge of the western limb.

The occultation of the first spot occurred at 2h. 36m. 20s., and occupied 55s.; the immersion of the second spot was completed in 30 sec., the third in 25 sec., and the fourth required 58 sec. from the moment of contact, until it had entirely vanished behind the moon's body; several other spots of minor consideration appeared scattered over the disc of the solar atmosphere. At 3h. 20m. a fine telescopic view of the planets, Venus and Jupiter, presented, and Aldebaran was faintly discernible. At the time of the greatest obscuration, the solar spectrum received upon a white surface from a large prism apparatus erected in the open air, represented the primary colours but imperfectly, the red ray appearing to

suffer the greatest degree of diminution, the yellow being the most conspicuous, the green next, while the violet appeared comparatively but little altered: shadows became broken and ill-defined, a chilling breeze sprung up from the north-east, the small birds seemed to chirp their vesper song and were retiring to rest, while nature appeared, as it were, to sustain a momentary pause.

W. H. WEEKES.

BRITISH MUSEUM.

The long expected Report of the Committee of Inquiry into the affairs of this establishment, was presented to the House on the 14th instant, and as it is only as yet printed among the Votes, and will not appear with the Evidence for some months, we think our readers will be anxious to see the results of this protracted and much-talked-of investigation. Although more might have been granted to the public, the recommendations of the Committee, *if properly acted upon*, cannot fail of being beneficial. We find that the salaries of the officers, &c., although they now amount to *eleven thousand pounds* a-year, are to be increased; that the Trustees are acquitted of all blame; that the establishment enjoys "a high reputation in the world of science," a fact with which we were hitherto unacquainted, and that the "talents, good conduct, and general and scientific acquirements of the officers are *universally* admitted; about which, we believe, great difference of opinion exists. But there is no mention of *an evening reading-room*, nor of a "*classed catalogue of the MSS. and printed books*," two objects so earnestly desired by the public, and so pertinaciously opposed by the officers of the Museum; but the evidence in favour of which, given by many talented individuals, is, in our minds, conclusive. The proposed alterations are in unison with many of Mr. Millard's suggestions, of whose plan we gave some account in a recent Number of the *Mechanics' Magazine;* but we regret to find no notice in these resolutions of a gentleman who has so essentially contributed to the improvement of our National Museum, who we know has been very harshly treated by the Trustees, and has been subjected to much unmerited obloquy for the active part he has taken in reforming this establishment, and rendering it worthy of the British nation. He has, however, *our* hearty thanks for his independent and fearless exertions, and we trust he will meet with that reward from the present liberal Government which he so eminently deserves.

Resolutions.

1. That the great accessions which have been made of late to the collections of the British Museum, and the increasing interest taken in them by the public, render it expedient to revise the establishment of the Institution, with a view to place it upon a scale more commensurate with, and better adapted to, the present state and future prospects of the Museum.

2. That this Committee do not recommend any interference with the family Trustees, who hold their offices under Acts of Parliament, being of the nature of national compacts.

3. That though the number of official Trustees may appear unnecessarily large, and though practically most of them rarely, if ever attend, yet no inconvenience has been alleged to have arisen from the number; and the Committee are aware that there may be some advantage in retaining in the hands of Government a certain influence over the affairs of the Museum, which may be exercised on special occasions; yet if any Act of the Legislature should ultimately be found necessary, a reduction in the number of this class of Trustees might not be unadvisable.

4. That, with regard to the existing elected Trustees, the Committee think it very desirable that the Trustees should take steps to ascertain, whether some of those whose attendance has been the most infrequent, might not be willing to resign their Trusteeships;—That, in future, it be understood, that any Trustee hereafter to be elected, not giving personal attendance at the Museum for a period to be fixed, is expected to resign his Trusteeship; being, however, re-eligible upon any future vacancy.

5. That in filling up vacancies it would be desirable that the electing Trustees should not in future lose sight of the fact, that an opportunity is thus afforded them of occasionally conferring a mark of distinction upon men of eminence in literature, science, and art.

6. That the extension of the collections which has taken place, and the still greater extension which may be looked for, render a further division of departments necessary; and that at the head of each department there be placed a Keeper, who shall be responsible for the arrangement, proper con-

dition, and safe custody of the collection committed to his care.

7. That it is desirable that the heads of each department shall meet once in three months, for the purpose of consulting with reference to any matters of detail relating to the internal arrangements of the Museum, which they may desire jointly to submit to the Trustees in writing.

8. That whenever there may be a vacancy in the office of principal Librarian, or in that of Secretary, it is desirable that the distribution of the duties now discharged by those officers respectively, including the Expenditorship, be re-considered, and that the office of Secretary be not combined with the Keepership of any department.

9. That it is desirable that the hours during which the Museum shall be open on public days, be hereafter from ten o'clock until seven throughout the months of May, June, July, and August; and that the reading-room be opened throughout the year at nine o'clock in the morning.

10. That it is desirable that the Museum be hereafter opened during the Easter, Whitsun, and Christmas weeks, except Sundays and Christmas-day.

11. That it is expedient that the Trustees should revise the salaries of the Establishment, with the view of ascertaining what increase may be required for the purpose of carrying into effect the foregoing resolutions, as well as of obtaining the whole time and services of the ablest men, independently of any remuneration from other sources; and that when such scale of salary shall have been fixed, it shall not be competent to any officer of the Museum paid thereunder, to hold any other situation conferring emolument or entailing duties.

12. That it is desirable that the heads of departments do consult together as to the best method of preparing on a combined system, an improved edition of the Synopsis of the Museum; that each officer be responsible for that part which is under his immediate control, and attach his signature to such part, and that the work be prepared in such a manner as to enable each part to be sold separately, which should be done at the lowest price which will cover the expenses of the publication.

13. That it is expedient that every exertion should be made to complete within the shortest time, consistent with the due execution of the work, full and accurate catalogues of all the collections in the Museum, with a view to print and publish such portions of them as would hold out expectations of even a partial sale.

14. That it be recommended to the Trustees, that every new accession to the Museum be forthwith registered in detail, by the officer at the head of the department, in a book to be kept for that purpose; and that each head of a department do make an annual report to the Trustees of the accessions within the year, vouched by the signature of the principal Librarian, of desiderata, and of the state and condition of his own department.

15. That it be recommended to the Trustees to take into consideration the best means of giving to the public a facility of obtaining casts from the statues, bronzes, and coins, under competent superintendence, and at as low a price as possible.

16. That the Committee are well aware that many of the alterations, which they have suggested, cannot be carried into effect, except by increased liberality on the part of Parliament, both with respect to the establishment of the Museum, and also to a much greater extent, for the augmentation of the collections in the different departments; but they confidently rely on the readiness of the representatives of the people to make full and ample provision for the improvement of an establishment which already enjoys a high reputation in the world of science, and is an object of daily increasing interest to the people of this country.

17. That the Committee, in the alterations which they have suggested, do not mean to convey any charge against the Trustees, or against the officers of the Museum, whose talents, good conduct, and general and scientific acquirements, are universally admitted; and they are aware, that where imperfections exist in the collections, those imperfections are mainly attributable to the very inadequate space, hitherto available for their exhibition, and to the limited pecuniary means at the disposal of the Trustees, and they are of opinion that the present state of the British Museum, compared with the increasing interest taken in it by all classes of the people, justifies them in the recommendations contained in the above resolutions.

18. That the Committee, having taken into consideration the petition presented to the House by Mr. Charles Tilt, and referred to the Committee, which petition prayed for public assistance in the preparation of a work from the medals in the British Museum, and having taken evidence on the said subject, consider that in no way can they more satisfactorily discharge the duty confided to them by the reference in question, than by simply laying before the House the Minutes of Evidence so taken, and ordering the petition of Mr. Charles Tilt to be placed as an appendix to that evidence, and to these resolutions.

REPARATION OF BLACKFRIARS' BRIDGE.

Report of the Select Committee appointed to consider the practicability of Widening and Improving Blackfriars' Bridge, and to Report their Observations thereupon to the House; and to whom was referred the Petition of Inhabitants of Chatham-place, Blackfriars, in the city of London; and who were empowered to Report the Minutes of the Evidence taken before them to the House:—Have considered the Matters referred to them, and have agreed upon the following Report:—

The attention of your Committee was first directed to the necessity of widening Blackfriars' Bridge, and upon this point the witnesses concur in stating, that the present width of the bridge is not sufficient for the traffic over it, and that accidents have frequently happened from that cause. The width of Blackfriars' Bridge, within the balustrades, is 41 feet 10 inches, upwards of 12 feet less than the width of London Bridge. Blackfriars' Bridge could be sufficiently widened, at an expense of about 32,000*l.*, during the repairs now in progress; but if the present opportunity is lost, the expense of widening the bridge, at any future period, would be more than double the sum for which can now be effected.

Mr. James Walker, the engineer employed to superintend the repairs of the bridge, has produced before your Committee a plan and model for widening Blackfriars' Bridge, the particulars of which are stated in his evidence. By widening the bridge, a change will be produced in the style of its architecture, by the removal of the columns over the piers. Upon this point your Committee have been attended by Mr. Mylne, the son of the engineer who built the bridge, but, after due consideration of the objections stated by Mr. Mylne, your Committee do not consider them of sufficient importance to prevent the widening of the bridge upon the plan produced by Mr. Walker.

In addition to the substantial repairs of the bridge, the Corporation of London have entered into arrangements for raising the carriage-way at each end of the bridge; and, after taking into their consideration the petition upon this subject from some of the inhabitants of Chatham-place, Blackfriars, in the city of London, your Committee have no doubt that the houses at each end of the bridge will be rather benefited than injured by raising the roadway at each end of the bridge.

The sum of 90,000*l.*, authorised to be raised by the Act of the 3d and 4th William IV., c. 118, for the repair of Blackfriars' Bridge, will not be more than sufficient for the repairs already contracted for by the Corporation of London; and it appears to your Committee that the Bridge-House estates, upon the surplus of which the sum of 90,000*l.* is charged, are not capable of providing for more than the amount of the present charges upon them, and that the Corporation of London have no other fund applicable to such a purpose.

Under these circumstances, your Committee are of opinion that the sum for widening Blackfriars' Bridge should be charged upon the fund for improving the approaches to London Bridge, consisting of the rate or duty of 8*d.* per ton on coals imported into the port of London, and the sum of 11,500*l.* per annum, and other sums paid by the Corporation of London, after the payment of the present charges thereon; and as the sum necessary for that purpose will not occasion a continuance of the duty beyond the period of eight or nine months, they do not see any objection to such a course.

Your Committee, being of opinion that the present opportunity of widening Blackfriars' Bridge should not be lost, recommend that a Bill be brought into Parliament, in the present Session, for the purposes aforesaid.

July 1, 1836.

EUPHRATES EXPEDITION.

The following extract of a letter is from the *Hampshire Telegraph*, and furnishes information of the progress of the expedition up to the 5th of May:—"After many tedious delays and vexatious annoyances, we completed the transport of the vessels and stores, to our station near Binjulo, in February. My vessel, the *Euphrates*, 200 tons, 50 horse-power, having the Colonel on board, made a trial up the river, on the 17th of March, and commenced the descent on the 19th: we seldom steam more than from 25 to 30 miles in one day, as we are obliged to have the boats on a-head for the survey, and the officers return by land to pilot the vessels. We have been twice aground, once for fourteen days, and again for three; the *Tigris* joined us at Kara Bam Boutch on the 18th April; she has also been aground for some days. We have been detained here some time, expecting a caravan of stores from Aleppo; on its arrival we shall push on to Giabour, where the *Tigris* is now waiting for us. Our scientific departments have made great progress, and, from the ample fields of Syria and Mesopotamia, have made abundant specimens, both in the geology, natural history, and topo-

dition, and safe custody of the collection committed to his care.

7. That it is desirable that the heads of each department shall meet once in three months, for the purpose of consulting with reference to any matters of detail relating to the internal arrangements of the Museum, which they may desire jointly to submit to the Trustees in writing.

8. That whenever there may be a vacancy in the office of principal Librarian, or in that of Secretary, it is desirable that the distribution of the duties now discharged by those officers respectively, including the Expenditorship, be re-considered, and that the office of Secretary be not combined with the Keepership of any department.

9. That it is desirable that the hours during which the Museum shall be open on public days, be hereafter from ten o'clock until seven throughout the months of May, June, July, and August; and that the reading-room be opened throughout the year at nine o'clock in the morning.

10. That it is desirable that the Museum be hereafter opened during the Easter, Whitsun, and Christmas weeks, except Sundays and Christmas-day.

11. That it is expedient that the Trustees should revise the salaries of the Establishment, with the view of ascertaining what increase may be required for the purpose of carrying into effect the foregoing resolutions, as well as of obtaining the whole time and services of the ablest men, independently of any remuneration from other sources; and that when such scale of salary shall have been fixed, it shall not be competent to any officer of the Museum paid thereunder, to hold any other situation conferring emolument or entailing duties.

12. That it is desirable that the heads of departments do consult together as to the best method of preparing on a combined system, an improved edition of the Synopsis of the Museum; that each officer be responsible for that part which is under his immediate control, and attach his signature to such part, and that the work be prepared in such a manner as to enable each part to be sold separately, which should be done at the lowest price which will cover the expenses of the publication.

13. That it is expedient that every exertion should be made to complete within the shortest time, consistent with the due execution of the work, full and accurate catalogues of all the collections in the Museum, with a view to print and publish such portions of them as would hold out expectations of even a partial sale.

14. That it be recommended to the Trustees, that every new accession to the Museum be forthwith registered in detail, by the officer at the head of the department, in a book to be kept for that purpose; and that each head of a department do make an annua report to the Trustees of the accessions withi the year, vouched by the signature of th principal Librarian, of desiderata, and the state and condition of his own depar ment.

15. That it be recommended to the Tru tees to take into consideration the best mea of giving to the public a facility of obta ing casts from the statues, bronzes, coins, under competent superintendence, at as low a price as possible.

16. That the Committee are well a that many of the alterations, which have suggested, cannot be carried into e except by increased liberality on the pa Parliament, both with respect to the estab ment of the Museum, and also to a greater extent, for the augmentation collections in the different departments they confidently rely on the readiness representatives of the people to mak and ample provision for the improvem an establishment which already enjoys reputation in the world of science, an object of daily increasing interest people of this country.

17. That the Committee, in th tions which they have suggested, mean to convey any charge against tees, or against the officers of the whose talents, good conduct, an and scientific acquirements, are u admitted; and they are aware, t imperfections exist in the collect imperfections are mainly attribut very inadequate space, hitherto a their exhibition, and to the limite means at the disposal of the T they are of opinion that the pre the British Museum, compared creasing interest taken in it by the people, justifies them in th dations contained in the above

18. That the Committee, into consideration the petitior the House by Mr. Charles T to the Committee, which p public assistance in the work from the medals in and having taken evid ject, consider that in satisfactorily dischar them by the refere simply laying bef of Evidence so tition of Mr. C appendix to th lutions.

graphy of this country. The river, as far as we know, is perfectly navigable up and down, for steamers of sufficient power, and proper construction. We have had always in the main channel, from one and a half to three fathoms water, the current varying from three and a half knots to five, in the rapids, in the low season; and four and a half knots to six, in the rapids, during the high season: the greatest rise between the two seasons is from fourteen to sixteen feet, and liable to constant fluctuations, the river always rising or falling. The *Euphrates* has steamed 5·6 knots over the ground, against a 4·4 current, when drawing three feet six inches on an even keel, engines working thirty and a half revolutions; therefore, as the river is considerably more torpid below us, we may reasonably expect to make a speedy voyage upwards. We carry many stores down with us, to place in depôt on the river, which makes our draught of water four feet; the descent is very anxious work, from the innumerable shoals, islands, &c.; but, please God, we shall weather all yet. As for the Arabs, we are always as ready for fighting as they are, and we contrive to frighten them out of their wits; but they are certainly the most arrant thieves in creation. The other day we experienced our first shipwreck of a large barge, carrying about forty tons of coals, stores, &c.; she was bilged on a rock, and sunk instantly in a rapid of nine fathoms water; the crew were saved, and the loss of not much consequence to us: we have now several smaller in our squadron. The Expedition has suffered much from sickness, and lost many of its number, but a reinforcement of six seamen from the *Columbine*, in the Mediterranean, and four soldiers from England, make up its original strength. I am happy to say our Commander has recovered, but, with many others, is subject to repeated attacks of ague."

NOTES AND NOTICES.

A society has been formed in Germany to extract *oil from flies*, for greasing wheels!*—*Cambrian.*

Aerostation.—A balloon is being constructed, under the direction of Mr. Green, of such dimensions as to be capable of carrying 10 persons. The gores of silk by which it will be formed are nearly 100 feet in length, the centre being about 4 feet in width, and verging at the extremity to nearly a point. When finished, the balloon will be about 70 feet high. It is made of the best manufactured silk. The net which will surround it weighs 3 cwt., while the whole apparatus, including net, but without gas, ballast, or passengers, will weigh about 7 cwt.

* *Fly-wheels, I suppose.—Printer's Devil.*

Improvements and Embellishments in Paris.—The granite for the pedestal of the obelisk of Luxor has arrived, and only awaits the decrease of the waters of the Seine to be landed. It consists of seven blocks, one of which weighs 120,000lbs. The Hotel Dieu, it is said, will shortly be taken down, to carry on the beautiful line of quays which extend along each bank of the Seine. The sick will be removed to the Invalides, which establishment will be broken up, and formed into several branches, in various parts of the country, where articles of provision, &c. are cheap.—*Paris Advertiser.*

British Museum Buildings.—With the exception of the interior finishings, the northern side of the British Museum is completed; and when the interior of this part is finished, the temporary communication on the western side to the Elgin Marble room, &c., will be removed, and made to correspond with the eastern side. It will be a few years before the old southern front, and the buildings round the entrance court-yard are taken down; but when they are removed, and the new buildings completed, the British Museum will be one of the most elegant architectural edifices, in the Grecian style of architecture, in the metropolis. The architect to the new buildings is Sir Robert Smirke.—*Architectural Mag. for July.*

Death of Mr. William Reed.—Dear Sir, it is with much regret that I have to inform you, that last night's *Globe* contains a notification of the decease of our talented friend, Mr. William Reed, Governor of the Emperor of Russia's paper-manufactory, at Peterhoff, in July last. The readers of the *Mechanics' Magazine* will learn with regret that this gentleman, whose interesting contributions to its pages have often excited their admiration, is now no more; and perhaps you will be kind enough to announce the painful intelligence in this week's Number.—Yours respectfully, W. Baddeley. 10, Wilderness-row, July 21, 1836.

We are induced (from prudential reasons) to defer our promised observations on the New Patent Law Amendment Bill till our next.

Communications received from Mr. Graves—A Parisian—Mr. Watkins—T. B. L.—C. R. N.—Mechanicus.

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C. E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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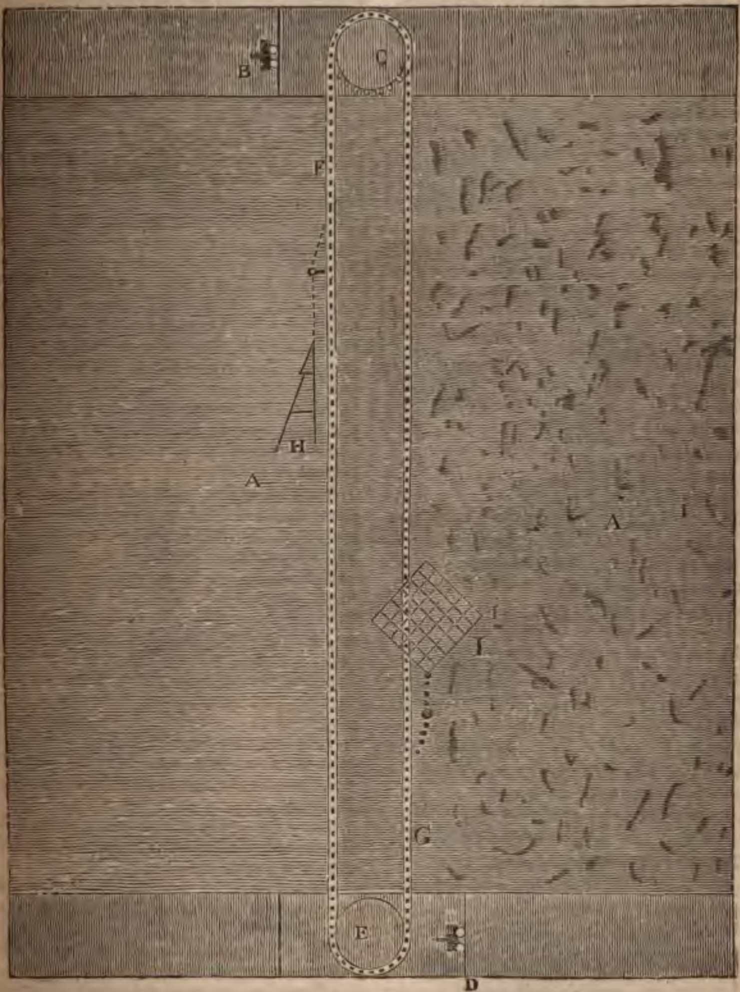
DICKSON'S STEAM-PLOUGH.



APPLICATION OF STEAM-POWER TO THE CULTIVATION OF LAND.

Sir,—During the last twenty years steam-ploughs have been frequently on the *tapis*, and perhaps ere long we shall see them going about and undertaking to plough fields for whoever may desire their assistance, and with very little more preparation than is now required to place a portable thrashing-mill. About the time that the Leeds Railway was done, when high-pressure engines were much improved, the idea of thrashing by steam led me to think of making a portable plough, applicable to all kinds of land. Now that public companies are forming that will require the use of such things, perhaps my old plan may be useful to some of them. I send you, therefore, a description of it, that you may publish it as soon as convenient.

The prefixed sketch shows my arrangements, made long ago, both for ploughing and harrowing land by steam-power. AA represent a piece of land to be ploughed; B, a carriage on small wheels (or rollers if the ground is soft), which carries the steam-engine to work the wheel C; D is another carriage, at the opposite end of the field, to carry another wheel E. On these two wheels I put an endless chain or rope FG, which, when worked by the steam-engine, will draw a plough H and harrow I in different directions; and when they arrive at the end, I cause both the carriages B and D to be moved the width of the furrow, either to the right or left, and reverse the motion of the engine to draw the plough and harrow back again. In place of an endless chain, a common one with cylinders will answer the same purpose, by using proper conducting pulleys on the opposite carriage. To mention any smaller details, I presume, is useless.

I am, Sir,
Your obedient servant,
J. Dickson, C.E.

9, Charlotte-street, Blackfriars-road,
June, 1836.

STEAM *versus* WATER.

(From the *American Mechanics' Magazine.*)

Few persons, even in this age of inquiry and improvement, seem to be aware of the vast superiority of steam over every other form of motive-power. Many are still, by *this assertion*, reminded of the anecdote of the famous Brindley. In giving evidence before a Committee of the House of Commons on the subject of Canals, he spoke of their superiority as a mode of communication in such decided terms, that a Member asked for what he thought rivers were intended? he unhesitatingly replied, "*to feed canals.*" Now, though we say that the manufacturer will one day "feed his boiler from the falls," we think that the assertion is not a bold one, and that it does admit of proof.

Some time ago, our attention was directed to a comparison of the expense of the two forms of power in the village of Lowell, possessed of the best water-power in the Union. The expense of steam to water was said to be as 100 to 125.

We have since often had this subject in mind, in reference to the more improved use of steam, and particularly to the economy of the rotary-engine of Avery.

Pursuing the comparison, we have collected some of the more prominent disadvantages of the usual hydraulic system, and the corresponding advantage of steam-power.

The first item of cost is that of the water-right, over and above the value of the ground as increased by any other advantages of locality. This expense is in no case trifling, and sometimes is positively enormous. There is, of course, no corresponding item of expenditure in the use of steam, an engine working as well on the top of a hill as in the bottom of a valley.

2d. The outlay upon wheels, dams, and other hydraulic works. This is often much greater than would be necessary for the average pressure, provided it were constant —that is, we are to erect works to support much more water than we have supplied through three quarters of the year. Freshets, &c. are to be provided against, at an increased cost. It is well known that in some locations the provision for such contingencies is no small portion of the whole capital employed.

It is this expense, other things being equal, that is to be compared with the cost of an engine, and the comparison is favourable to the latter.

3d. After every precaution, damages from floods are of constant occurrence, and their repair is exceedingly costly.

4th. The delay caused by freshets, &c., producing a stoppage from the too great supply of power.

5th. The delay in seasons of drought, when the supply is insufficient.

These last are most vexatious occurrences, preventing work often times when most is to be done, and the uncertainty arising from the possibility of such delays and accidents, is a constant care to the manager of such an

establishment; whereas to the consumer of steam, the perfect certainty of the amount and regularity of the supply of power is a great auxiliary in conducting business.

For a steam-engine, the only use of water is a sufficiency for the boiler; and in these days of economy of heat and steam, a very small quantity of fuel is used, and but little water. We have seen a rotary-engine, estimated at 15-horse power, evaporating but 40 gallons per hour.

6th. Delay in winter, and in our uncertain climate this may sometimes be considerable, and, in an establishment of great extent, perhaps fatal.

To balance all these expenses, peculiar to the use of hydraulic power, there is, as far as we can recollect, but one peculiar to that of steam, namely, *fuel*. Now, in saw-mills this expense is nothing, and in all instances much less than formerly.

Our persevering countryman, Dr. Nott, has already succeeded in greatly reducing this item of cost—and he does not yet appear to be satisfied.

As regards fuel, Avery's engine has immense advantages over others, inasmuch as the quantity of water used is less than in any other case. The elasticity of the steam operates more advantageously than in any other construction, the small quantity of water used being a proof of this.

In the engine above referred to, the cost for coal was rather less than one dollar for ten hours.

It is almost needless to observe that, in many large establishments, manufactories, &c., the application of a portion of the steam to heating, &c., nearly, if not quite, compensates the cost of fuel. The certainty and uniformity of this method of drying goods have fully established its superiority. Indeed, in the art of dyeing, certain colours owe their brilliancy to the rapid and high heat of steam, and they could be produced in no other way. While speaking of this use of steam, we must notice an engine erected in the Astor Hotel. This is a small engine of 5-horse power; its use is to pump water from the different cisterns to all parts of the house—supply the baths with hot and cold water—clean knives—brush shoes—roast and grind coffee; and the steam cooks the various dishes in the kitchen, and also dries the clothes, which by this method of proceeding are ready for use with unprecedented dispatch.

To these and numberless other uses is this engine turned, saving an immense number of servants, a great quantity of fuel, and a vast deal of time.

(The exhaust steam-pipe of this engine is over 300 feet long.)

One of the greatest advantages of steam-power, *in many cases, is*, that it admits of change of locality, without injury to the machinery, and often with benefit to the employer.

In this respect, again, Avery's engine stands pre-eminent. The machinery is beautifully compact, and consequently portable. An engine of 15-horse power is hardly a load for a horse, the whole weighing less than 600lbs.

Let us suppose, that a man purchases a piece of timber land, of prime quality, but, unfortunately (as is thought), away from any water-course.

Let him procure an Avery's engine; and this, connected with his saw-mill, can be placed upon wheels and moved, by the engine itself, if he pleases, to any part of his land. (Mills capable of such an arrangement, and very compact, are now easily to be procured.)

Let him locate his mill near a spring, and commence operations. The waste and rubbish, that in most cases is a drug, is entirely consumed by the engine; the ground is cleared, and nothing is to be removed but the perfectly formed timber.

Among other useful applications of such an engine, in the forest itself, no one can be equal in beauty of operation to the valuable stave-machine of Philip Cornell, N. Y. This machine promises to be of great service. With such an arrangement as that of the saw-mill above-mentioned, nearly, if not quite, double the usual number of staves can be cut from the timber before transportation, and these are already dressed and ready for use, either for liquids or solids.

These are only a few of the very many useful applications of this sort of travelling machines. Others will suggest themselves to our readers.

It must be very evident that, whatever brings into use property of little or no value, enabling the produce of such land to compete successfully with that of much better, must add to the wealth of the landholder, or timber-merchant, a sum equal to the cost of the best land.

Thus a great uniformity of value would result, and of consequence a more equal competency to those on, or away from, great water-courses and canals.

WORK DONE BY THE TEN BEST ENGINES OF THE LIVERPOOL AND MANCHESTER RAILWAY, DURING THE YEARS 1831, 1832, 1833, AND THE TWELVE FIRST WEEKS OF 1834.

(From Pambour on Locomotion.)

This statement shows what can be expected from locomotive-engines, when constructed with care and of good materials; and there is no doubt that, in time, more work will still be obtained from them.

Year.	Name of the Engine.	Total distance travelled by the Engine.	Total Time the Engine has been on the Road, either in Activity or in Repair.
		Miles.	Weeks.
1831	Mercury . . .	23,212	52
	Jupiter . . .	22,528	44
	Planet	20,404	52
	Saturn . . .	19,510	38
	Mars	18,645	50
	Majestic . . .	18,253	52
	North Star . .	15,677	52
	Northumbrian .	15,607	52
	Phœnix . . .	15,405	52
	Sun	13,434	37
	Sum	182,675	481
	Average per week	380	
1832	Vulcan . . .	26,053	52
	Liver	22,651	43
	Venus	20,464	52
	Etna	20,399	52
	Saturn . . .	20,312	52
	Vesta	17,739	52
	Victory . . .	17,082	52
	Planet	16,885	52
	Sun	16,535	52
	Fury	15,603	52
	Sum	193,723	511
	Average per week	379	
1833	Jupiter . . .	31,582	52
	Ajax	26,163	52
	Firefly	24,879	39
	Liver	23,134	52
	Pluto	20,308	52
	Vesta	19,838	52
	Leeds	19,364	48
	Saturn . . .	18,738	52
	Venus	18,348	52
	Etna	17,763	52
	Sum	220,117	503
	Average per week	438	
1834	Firefly . . .	8,542	12
	Vulcan . . .	8,526	12
	Saturn . . .	7,290	12
	Liver	7.080	12
	Sun	7.080	12
	Etna	6,557	12
	Leeds	5,712	12
	Ajax	4,890	12
	Venus	4,632	12
	Pluto	4,246	12
	Sum . . .	64,555	120
	Average per week	538	

Among those engines, the Liver had worked for 107 weeks, had travelled 52,865 miles, or, on an average 494 miles a week during all that time; the Firefly had worked 57 weeks, had travelled a distance 33,421 miles, or 586 miles per week, and neither of these engines at the period in question, had yet required a fundamental repair.*

MARBLE CEMENT.

An important improvement, which has been for several years in progress, is about being introduced to the more general notice of the public, and we believe into extensive use for building purposes. It is a composition or cement, of which the principal ingredient is marble or lime stone, which, when applied to the inner or outer walls of buildings, presents the appearance of polished marble, of the various hues and qualities which distinguish the beautiful material imitated. What would be thought of a magician who possessed the power of changing the sombre brick and stone walls of the buildings of a city, in one week, into substances resembling the most beautiful Grecian, Italian, Egyptian, or Verd Antique marble, or porphyry, like the rock of Gibraltar! Yet all this may be done by this invention of a humble citizen, of Orange county, in this State. This cement has been sufficiently tested by experiments on buildings, to satisfy practical men of its decided superiority over any other cement, stucco, or other hard finish for walls, hitherto known. In our next Number we expect to be able to furnish the public with some interesting particulars on this subject; and in the mean time we can state, that a Company has been formed in this city to carry on the operations connected with the manufacture of this new cement, and its application to buildings.—*New York Railroad Journal.*

ASTRONOMICAL OBSERVATIONS FACILITATED; OR, A NEW GUIDE TO THE OBSERVATORY.

Sir,—In the *Memoirs of the Astronomical Society of London,* vol. ii. p. 516;

* The greater part of these excellent engines were built by R. Stephenson, so well known for his important and numerous improvements in this branch of industry.

The Liver engine, the merit of which is sufficiently established by the above stated facts, is the work of Messrs. Edward Bury and Kennedie, of Liverpool.

also, in the *Edinburgh Journal of Science*, No. XI., p. 174, is given the observations of Professor Struve, of the Dorpat Observatory, on Saturn and his ring, and on Jupiter and his satellites. And in the same Journal, No. I, *new series*, p. 181, is given as follows, viz. " his *new results* deduced from a much greater number of observations. Their accuracy may be inferred from the slight difference between the old and new results;" and which are as follows:—

	1st Observations.	Difference.	2nd Observations.
	"	"	"
Outer diameter of outer ring	40·215	0·120	40·095
Inner ditto	35·395	0·106	35·289
Outer diameter of inner ring	34·579	0·104	34·475
Inner ditto	26·748	0·080	26·668
Equatorial diameter of Saturn	18·045	0·054	17·991
Breadth of the outer ring	2·410	0·007	2·403
Space between the rings	0·408	0·001	0·407
Breadth of the inner ring	3·915	0·012	3·903
Distance of the inner ring from Saturn........	4·352	0·013	4·339
Equatorial radius of Saturn	9·022	0·027	8·995
Equatorial diameter of Jupiter	38·442	0·115	38·327
Polar diameter of Jupiter	35·645	0·107	35·538
Mean diameter of Jupiter's 1st satellite	1·018	0·003	1·015
Ditto 2nd ditto	0·914	0·003	0·911
Ditto 3rd ditto	1·492	0·004	1·488
Ditto 4th ditto	1·277	0·004	1·277

The first column in the above table is the same as given in the *Memoirs of the Astronomical Society*, vol. ii. p. 516, and in the *Edinburgh Journal*, No. XI. The next, or middle, column is the $\frac{1}{334}$th part of that preceding. The last column is from Professor Struve's new results, as stated in the above Journal, which are nothing more than a reduction of his first observations, as the $\frac{1}{334}$th part of the first column is the precise difference between the first and the second observations of Professor Struve, with the exception of the fourth satellite only of Jupiter, which, it appears, the professor forgot to correct! Now, had the professor's micrometer, in the first instance, given the diameters too large, why not state that a reduction was necessary, and that the latter measures were the results of such reduction, instead of *assuming* that they were obtained from *a more numerous set of observations* than in the first instance? As it is millions of times more probable, that if fifteen dice were thrown out of a box that they should all of them come up aces, than that the above results should obtain from observation only!!

Now, Dr. Herschel was in possession of a telescope of a magnifying power ten times superior to that of Fraunhoffer's; it is therefore very unlikely that Dr. Herschel should have been in error one-seventh part of the whole, if observations can be made in England with any thing like the precision attained to by Professor Struve, as there is a difference resulting from the measurements of the two observers in the exterior diameter of Saturn's ring of 28,500 miles.

I am, Sir, yours, &c.,
J. UTTING, C.E.

Lynn Regis, July 22, 1836.

SIDERIAL TIME.

Sir,—Your scientific correspondent, Mr. T. G. Waldron, thinks (see No. 674) that the longitude of a ship at sea might be correctly found by means of a chronometer made to keep siderial time, and *adjusted to some port whose longitude is exactly known; of course*, Greenwich is the place best suited for that purpose, as all the articles in the *Nautical Almanac* are computed for Greenwich time. Mr. Waldron states, that by observing the exact time that any fixed star passes the meridian, by a siderial chronometer set for Greenwich time, the longitude of

the ship may be determined. This is no doubt all true, provided you know that your chronometer is right for Greenwich time, or that the quantity of its daily gain or loss of time has been previously established; and also that you can determine by an observation, or a set of observations, the exact time by your chronometer (or within a small fraction of a minute) when the star transits the meridian. Before proceeding further I would remark, is there any thing particular in a siderial chronometer that gives it a preference over that of a chronometer that keeps mean solar time (the principle upon which all marine chronometers are constructed)? I certainly answer none whatever, or rather the advantage for the navigator would be in favour of a chronometer set for mean solar time. A siderial and a mean solar day are both constant portions of time;* a siderial revolution of 24 hours is exactly equal to 23h. 56m. 4·0906s. of mean solar time; and 24 hours of mean solar time is equal to 24h. 3m. 56·5554s. of siderial time. In order that we may judge of the merits of both methods for determining the longitude at sea, suppose that on March 31, 1836, a ship at sea found by an observation that the star Regulus passed the meridian at 11h. 10m. 20s. p.m. by a siderial chronometer regulated for Greenwich time, then to determine the longitude of the ship:—

	H.	M.	S.	
Regulus passes the meridian of Greenwich, March 31, 1836, at....................	9	59	39	siderial time.
By the chronometer	11	10	20	
Difference of meridian in time............	1	10	41	siderial.
1 hour siderial time....................	0	59	50·2	mean solar time.
10 minutes	0	9	58·4	
41 seconds	0	0	40·9	
Difference of meridian in mean solar time....	1	10	29·5	

Hence ($\overset{H.}{1}$ $\overset{M.}{10}$ $\overset{S.}{29·5}$) × 15 = 17° 37′ 15″ W. longitude.

Now, a chronometer which indicates on March 31, 1836, 11h. 10m. 20s. of Greenwich siderial time, would be expressed by a mean solar chronometer at the same instant,

	H.	M.	S.	
and also set per Greenwich time by	10	33	3	mean solar time.
Regulus passes the meridian of Greenwich, March 31, 1836......................	9	22	33·5	
Difference of meridian in mean solar time..	1	10	29·5	

The difference of the meridians by both methods being exactly the same—and, of course, the longitude the same.

But I am afraid that the longitude determined by the above method could not be altogether depended upon. The only method (as far as I am aware of) of determining the time at sea when any of the heavenly bodies pass the meridian, is by taking a number of altitudes before and after the star passes the meridian, carefully noting the corresponding times indicated by the chronometer; then the time opposite to the greater altitude will be that of the star's passing the meridian. But every one knows who has considered the subject, that for a small portion of time before and after any of the heavenly bodies come to the meridian, there is hardly any perceptible change in their altitudes; and that an error of 1 minute of time produces an error of 15 minutes of longitude; or if 4 minutes, the error would be a whole degree of longitude. Or if equal altitudes of the star were taken when a considerable way to the eastward and westward of the meridian, the middle time (if the ship was lying to, or making little or no way during the time of taking the altitudes) would indicate (as there is no change of declination) the time the star passed the

* *The difference between apparent siderial time and mean siderial time amounts only to* $2\frac{1}{16}$ *seconds in 19 years.*

meridian. But if the ship was sailing during the interval, still, although in this case, certain corrections might be made, errors of one, two, or perhaps three minutes might occur. In short, Mr. Waldron's method, I am afraid, if put to the test, would be found not to answer; and more so, when so many methods are now known for determining the longitude at sea to a degree of accuracy nearly equal to that of finding the latitude.

I am, Sir,
Your most obedient servant,
A Country Teacher.

SYMINGTON'S CONDENSATION BY INJECTION.

(Communicated by the Inventor.)

The encrustation of the boilers of marine-engines has been long acknowledged one of the greatest drawbacks to the application of steam to navigation; and the many evils arising from it—particularly in sea-going vessels—are too familiar to every practical engineer to require explanation. The great loss of power from blowing out the boilers; the great waste in fuel to supply the place of so much hot water; the valuable space occupied by a larger quantity of coals than would otherwise be required; together with the rapid wear of the boilers themselves, even under the most careful management;—are among the disadvantages with which steam-ships engaged in the coasting trade, or destined for foreign stations, have to contend. Economy of space and fuel, and the durability of the boilers, are objects of the first importance; and whatever will, in a simple and effectual manner, come in aid of these requisites (without introducing other disadvantages), must be considered an important advance towards perfecting steam navigation.

I am encouraged to think that I have devised a remedy for these evils, simple and cheap in its application, taking up no room, adding nothing to the tonnage of the vessel, and perfectly efficient in its operation. It appeared to me not a little singular, that so many attempts should be made to condense *inside* the vessel by means of unwieldy tanks, which, at the best, must be but imperfect coolers, when *there is so simple and perfect* a condenser *outside as the open sea or river.* I conceived that by cooling down the water in the hot well to the temperature of the external water, by means of a pipe, so placed *outside* the vessel as to receive the direct action of the water, in order that condensation might be effected by injecting, again and again, a portion of the same water, while the remainder is returned to the boiler, it would succeed—more especially as such a plan would involve no alteration in *principle*—in producing a most simple and perfect mode of preventing encrustation, applicable with the greatest facility to any vessel in a few days, and without making any alteration in the engine itself. By this method, the injection-water, after condensing the steam, is conveyed in the usual manner by the air-pump into the hot well, from whence a portion of it enters the refrigerating-pipe at about 96°; and by the rapidity with which the pipe is brought into contact with the constantly changing particles of water by the motion of the ship, every portion of warmth is speedily given out; and long before the water completes its passage, it will become of the same temperature as the external water, and thus be ready for injection again. The remaining portion of the water escapes to the boiler by means of a float *in the hot well,* which moves on friction-rollers, in front of the orifice leading to the feed-pump, and rises and falls freely with the rise and fall of the water in the hot well. It is evident that by this means the circulation of the water in the refrigerating-pipes will be kept up with the utmost regularity, as only the precise quantity that has been previously used for injection will again flow into the refrigerating-pipe, to supply the vacancy thus momentarily occasioned, for the purpose of again being injected; whilst the remaining portion of the condensed steam, which will be the exact quantity that has been evaporated, will elevate the float in the hot well until it has escaped to the feed-pump. Thus the same water will be used over and over again in the boiler, and encrustation effectually prevented; while, at the same time, the supply will be in exact proportion to the quantity evaporated, and, on account of the simplicity of the contrivances, without any risk of derangement in either case. The steam from the safety-valve will be condensed by leading it into the condenser or external pipe; and by ap-

plying a small cock to the pipe, near its entrance to the condenser, the engineer can at all times ascertain the temperature of the injection-water, and, by its circulation and purity, that the pipes are free from injury. These will be made of the best stout copper, so as to be abundantly durable, and will, in fact, require repair much less frequently than the copper sheathing of the vessel. It will be seen by the position of the pipes, that they are so embayed as to render it almost impossible for them to receive an injury, unless it be of such a nature as would be equally injurious to the vessel; but in the event of any unforeseen accident occurring, as the old injection-passage and discharge-pipe from the hot well will be left free to act, the engineer has merely to turn on the injection-water, and the same process will go on as if they had not been attached. Thus it is that the simplicity of the means employed; its durability, and consequent cheapness, as well in its first cost as afterwards; the little liability to derangement; and, should an accident happen, the momentary readiness with which the old plan can be resorted to; *together with the principle remaining unaltered in the application*;—render such a mode of preventing encrustation particularly deserving the consideration of all who are interested in steam navigation.

Many attempts have been made to prevent encrustation, by condensing without the usual jet, and although the plans hitherto adopted have been eminently successful—so far as the prevention of the encrustation is concerned—yet the best of them has been by means so expensive, so complicated, so liable to derangement from the numerous joints, occupying so much valuable space, and adding so much to the tonnage of the vessel, as to render even encrustation preferable, in most cases, to such a remedy. The mere circumstance of a good vacuum being produced, can be no test of the effective power of the engine, unless the means employed to produce it be also taken into account. Dr. Lardner, in his recent work on the Steam-Engine, has, with his usual discrimination, detected this fallacy. There is no difficulty in creating a *perfect* vacuum when a much larger air-*pump than is used in injecting engines is employed; but it follows*, that as this is *necessary for non-injecting* engines, as well as an extra and powerful force-pump to keep up a stream of cold water in the cisterns, they *must be* burdened with additional duty to perform, from which injecting-engines are free, consequently that the quantity of power uselessly expended in producing the vacuum and doing this extra duty deducts just so much from the *effective* power of the engine. Nor is it *possible* to effect condensation with an air-pump of the same capacity, in so instantaneous and effectual a manner, without the usual condensing-jet, whatever may be the means employed, or how great soever the extent of metallic surface exposed. The opinions of all scientific and practical engineers have long been decided upon this point, for it is impossible for steam to be brought so immediately in contact with a cold surface, however minute may be the divisions to receive it, as it will be by meeting with a stream of cold water dashed amongst it, every separate particle of the water taking hold of a portion of the steam and blending intimately with it.

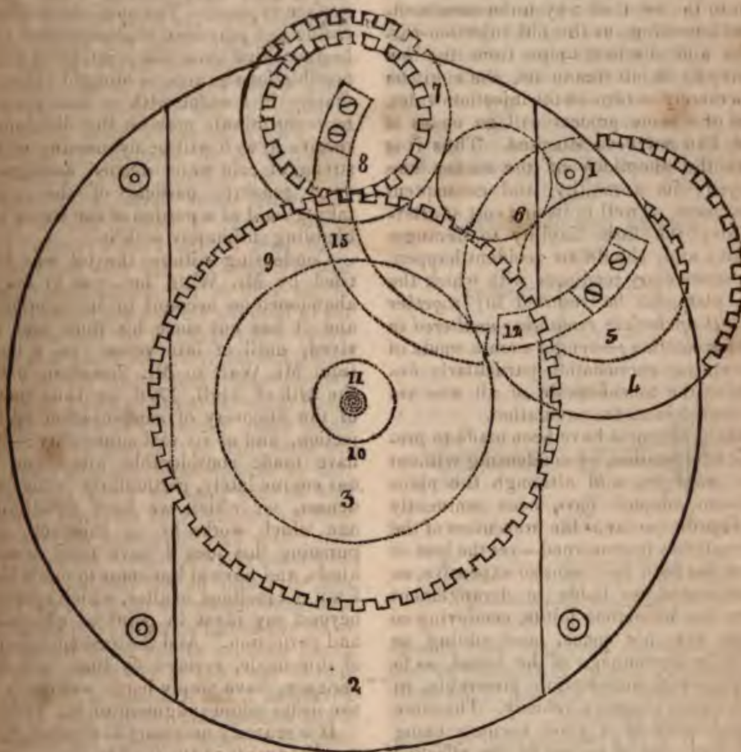
Condensing without the jet was long tried by Mr. Watt, but was at length abandoned on account of its inferiority, and it has not since his time been revived, until of late years. In a letter from Mr. Watt to Mr. Smeaton, dated the 24th of April, 1776, he thus speaks of the discovery of condensation by injection, and of its vast superiority:—"I have made considerable alterations in our engine lately, particularly in the condenser, for which we have substituted one which works by an injection. In pursuing this idea I have tried several kinds, and have at last come to one which I am not inclined to alter, which operates beyond my ideas in point of quickness and perfection." And the vast superiority of this mode, verified by time and experience, have amply borne testimony to the usual sound judgment of Mr. Watt.

It is scarcely necessary to observe, that the disadvantage attached by some—now first discovered after an experience of more than sixty years—to injecting-engines, from the supposed liability of the condenser and air-pump becoming choked with injection-water, however feasible it may appear in theory, can scarcely ever occur in *practice*. Independently of there being a very accurate index to marine-engines, by which the supply of injection-water can be regu-

lated with the utmost nicety—and such is the perfection to which the steam-engine is now brought, that the engineer has little else to attend to—it is seldom found that an engine is brought up for more than a few seconds at a time; and when this does happen, no sooner will the condenser become partially filled, than it will have a tendency, by diminishing the vacuum, to lessen the supply, and the next stroke or two it is completely discharged. Non-injecting engines, therefore, have only an imaginary advantage over injecting-engines in this respect, but particularly as regards the present mode, on account of no air whatever being admitted with the injection-water; for after a few strokes of the air-pump, all air is expelled through a valve which opens upwards in the hot well, and cannot again re-enter.

W. S.

ECCENTRIC CHUCK.



Sir,—If you will allow the following description of a chuck I have made for my own amusement to appear in your widely-circulated Magazine, I should be obliged. I believe it is quite on a new principle, at least different from any chuck I ever saw. The variety of patterns it will execute is almost infinite. The wheels 3, 4, 8, 9, may have any number of teeth; and any of them being changed for a wheel of different number of teeth, will produce a different pattern.

I am, Sir, yours, &c.

J. Wilbee.

Southbroom National School,
Devizes, June 6, 1836.

Description of the Engraving.

The chuck is made of two circular pieces of metal, framed together by the four little columns marked 1, which

keep the two plates about 3-8ths distant from each other. There is a slide 2 on the top of the upper plate, similar to, and for the same use, as the eccentric chuck-slide. The wheel 3 is fixed on the face of the puppet (any size or number of teeth); 4 is a wheel that works in fig. 3, and carries fig. 5 on the same spindle, but fig. 5 works between the plates, as does fig. 6, which works in it; fig. 7 works in fig. 6, and carries the wheel fig. 8 on the same spindle in the front of the upper plate, and works in the large wheel fig. 9, to which the work is fixed. The line in the centre, fig. 10, is the screw in the under plate to screw the chuck to the mandril of the lathe. Fig. 11 is a large screw in the centre of the wheel fig. 9, for fixing the work to the wheels. Nos. 3, 4, 8, 9, may be of any size or number of teeth. The slides 12 and 13 are for the purpose of bringing the different size wheels to work together.

MARINE LIFE-PRESERVER.

Fig. 1.

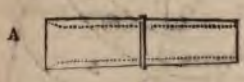


Fig. 2.

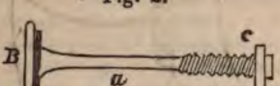
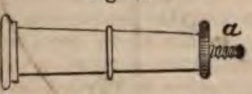


Fig. 3.

Fig. 4.



Sir,—As you have been kind enough to insert my idea of a life-preserver (see p. 135), I send you a sketch of the small tube therein mentioned.

Fig. 1. A is a tube one inch in length, tapering one quarter to one-fifth of an inch; B, a raised rim to prevent its slipping in when fastened. The dotted line shows the size and shape of the bore. The tube to be made of bone, ebony, ivory, or brass, as may be convenient.

Fig. 2. A is a brass bar, firmly secured *to the stopper* B, the dark part of which *shows* a washer of liquored leather; *C, a brass nut with* which to tighten the *stopper when the bag* is inflated.

Fig. 3 shows the face of the nut, having four holes in it to allow an entrance to the air.

Fig. 4 shows the whole complete, with A a knob to keep the nut on.

I am, Sir, &c.

CAMPO-BELLO.

NEWTONIAN THEORY OF THE TIDES.

Sir,—I have no wish to take any active part in the controversy on Mr. Macintosh's Electrical Theory of the Universe; my only motive is to correct a mistake which your correspondent Ursa Major has fallen into. He says (No. 666, p. 93), "For example, what can appear more plausible than the theory of the two tides when explained upon electrical principles? The paradox of the tides has always formed a most formidable objection to the doctrine of universal gravitation, to which even La Place himself could never devise a satisfactory answer," &c. I should like to know what part of La Place's works Ursa Major alludes to. He will find nothing of the kind in the *Mechanique Celeste*, for in both the 1st and 4th books of that work, when treating of the motion of fluids and the tides, La Place has there demonstrated, that when the sun and moon cause the ocean to swell to places under them, there is also a high tide at the same time in that part of the ocean that is diametrically opposite; and all this he has done in strict accordance with the principles of universal gravitation. But La Place was not the first who made this discovery. Newton himself, although he left the lunar theory, and consequently the theory of the tides, in an unfinished state, has still traced the grand outlines of the lunar theory and that of the tides in the 3d book of the *Principia*. The Academy of Sciences at Paris selected this difficult part of physical astronomy, namely, the theory of the tides, for investigation in 1740. Among the great competitors who contended for the prize, the successful ones were Euler, Maclaurin, and Daniel Bernoulli. The masterly investigation which our countryman, Maclaurin, gave of this difficult problem may be seen in his "Treatise of Fluxions." Since that period every writer of eminence in physical astronomy has demonstrated the same thing; and all their demonstrations are founded upon the unerring principles of

universal gravitation. So that instead of there being any paradox about the matter, if the contrary had really been the fact, this of itself would have been almost sufficient to overturn the theory of universal gravitation.

I am, Sir, yours, &c.

KINCLAVEN.

York-buildings, New-road,
July 24, 1836.

THE NEW PATENT LAW AMENDMENT BILL.

Sir,—It is again attempted, it seems, to twist the crooked Patent Law into some conformity with justice. Mr. Mackinnon has undertaken the task; but, I fear, is likely to endure the disappointment of those who begin their business at the wrong end. Until the fundamental principle of the patent law is changed, I conceive there cannot be either security to inventors, justice to the public, or permanence in the law.

Several of the proposed enactments are entitled to the credit of diminishing expense and delay. To render Letters Patent for England valid over Scotland and Ireland also, on simply enrolling additional specifications for those kingdoms—to reduce the stamp-duties to 2*l.*—to substitute temporarily the signature of either of the Chief Justices for the King's signature—and to give protection to the inventor from the date of his petition—are useful alterations in the practice of the system, if its principle is to remain unchanged; but much more than this ought to be accomplished—and might be, were the fundamental error, that a patent confers a privilege, exploded, which it must be before the law can rest long in any one attempted state.

It is a misfortune, and not a small one, that patents for inventions have descended historically as arbitrary grants of privilege. While inventions were yet rare, and monopolies granted by Royal favour were yet common, the most convenient, perhaps the only practicable, mode to the inventor of securing the fruits of his labour was to beg a monopoly of his invention; the essential right of the inventor was thus lost sight of in the appearance of privilege—and the error has not been *entirely discarded to this day. The almost annual attempts at amending the patent laws* are only so many trials to make the theory of privilege, and its consequent practice, fit the universal feeling of right; but the crooked billet offers no face that will fit.

From this theory of privilege arises the necessity of affixing the signature of his Majesty to Letters Patent; and to obviate the inconvenience of delay in obtaining it, the Bill proposes to substitute temporarily the signature of one of the Chief Justices; but if the granting of a patent be not the conferring of a privilege, but the defining and registering of a right, what need is there of the signature of his Majesty, or his Majesty's substitute at all, more than to a thousand other documents? The authentication of the record, under proper regulations, by a competent public officer appointed for that business, would answer the purpose far more effectually, more cheaply, and with much less irregularity and delay.

The cumbrous machinery by which the present law is worked, is not further affected by the Bill. But to what purpose can it be, that patents for inventions are submitted to the Attorney-General?—a gentleman of a class, perhaps, of all others disqualified by the nature of their studies from judging of their merits,—an officer, perhaps, of all others unable, from the multiplicity and importance of his engagements, and his uncertain tenure of office, to give them the necessary attention. It is easy to see how this practice has arisen out of the aforesaid theory f privilege; but is it not equally clear that, to do the needful justice, patents for inventions must be separated from other patents, and a separate department established for their supervision? Ought not the whole property in invention, whether in literature, in science, in the fine arts, or in manufactures, to be placed under the protection of a separate tribunal, constituted with a view to this special duty?

In his zeal for the interests of patentees, Mr. Mackinnon seems to have forgotten that there are other parties who have rights too, or he surely could not have proposed the 8th and following clauses, by which, under a Judge's warrant, granted on an ex-parte hearing to a suspecting patentee, any designated workshop, &c. may be searched for infringements. Now wherever any invention is in progress, in customary privacy, there are always abundant and usually

very inaccurate reports of its purpose; and however different the real object of the inventor, it is certainly never difficult to muster circumstances enough to countenance a suspicion that piracy is intended. But is it not a monstrous injustice to the new inventor, that his workshops should be ransacked and his plans exposed upon a real or pretended suspicion of piracy? and all this without warning, without opportunity of disproving the suspicion, without guarantee of secrecy, without right of action, without limitation, without remedy? It certainly would not be difficult to find those, who having bought up most of the patents in a manufacture, would be in condition, as soon as this Bill has passed, to rummage the workshops of half the trade. As for remedy by action at law, what is that to a needy, struggling, though clever, inventor, especially if opposed, as he probably would be, to the Leviathan of his trade? A little inquiry into the usual progress and actual state of any of our great manufactures, would convince Mr. Mackinnon that *in its present form* this part of his plan would work most grievous wrong.

While piracy of an invention is undoubtedly robbery, and ought to be pursued, whether by search or otherwise, with the same vigour as theft, there is an important difference to be noted between the search for stolen goods and that for infringement. In the former case, if property is carried away under pretence of search, the fact is easily proved, and redress readily obtained,—the restoration of the goods sets the main matter right; but in the latter the property, consisting merely in the knowledge of the processes carried on, may be, and in most cases would be, stolen by means of this search obtained on suspicion, and carried away and used without redress to the robbed inventor, and not unfrequently to the barring of his just patent right;—things cannot be placed on their former footing. Before Mr. Mackinnon procures the passing of these clauses, he ought, by every consideration of justice, to devise some mode of *preventing* this abuse: no subsequent remedy can apply. Let him do so, and *then the search* he proposes is but a *righteous hunting out* of thieves and receivers. More, perhaps, is to be expected from the inculcation of the maxim, that he who infringes is a thief, and ought to be scorned as such, than from any positive enactment, useful as it may be.

The most novel feature of the new Bill is a proposal to establish a register for designs; the property in which is thus to be secured for twelve months on payment of ten pounds. This may be a step towards something better; but a protection for twelve months! and a fee of ten pounds! Of what utility can so chargeable a regulation for so short a protection be to the manufacturer of stoves, of stamped brass goods, of cottons, of lace, of shawls, or of any thing made by wholesale? His patterns are indeed now stolen from him in the face of day; and whatever may have been the cost or talent by which they have been produced, some unscrupulous neighbour impudently appropriates the profits. Need enough is there, of remedy to wrong, and impolicy like this, as the evidence already given in your pages amply testifies, and Mr. Mackinnon deserves thanks for even attempting to root out this crying injustice. But of all the designs offered to the public, many fail, and the manufacturer frequently cannot tell beforehand which will hit the public taste and which will not; yet he must register all, and pay upon all, or be robbed of those, and those only, which succeed. Few manufacturers, if any, can stand an expense like this; to them it will be useless in its present form, though it may be of advantage to the higher arts; and if it do not entirely break down from its obvious failure in practice at first (which is far from impossible), it may prove the imperfect beginning of a better system.

Sufficient attention has not, I conceive, been paid to the principle by which the duration of patents ought to be regulated. In cases where there is no possibility of the same thing being done over again independently by another person (as, for instance, the writing of a book), there seems to be justice, and *therefore* good policy (for justice is always conducive of good policy in the long run), in making the proprietorship perpetual. But the period should be shortened in proportion to the probability of independent reproduction by others. There might be some difficulty in applying the principle accurately to every case; but surely some approximation may be devised

nearer to the right than the present single term for all patents, even when the eventual doubling of it and the new term for designs are taken into account.

It cannot but be regretted, that this important subject should be left to wearied midnight legislation. It is true, great interests may be maintained upon the progress in invention already made, but the rapidity and the character of the future progress of society, will be materially affected by the degree of safety afforded to property in invention. It is not a subject to be dealt with by starts, at hazard, or with limited views, and ought not to be left to share the neglect of minor crotchets and temporary schemes. Those who are intrusted by the community with high powers for the maintenance of justice, will have but sorrily fulfilled the trust they have undertaken, till all classes of those who labour intellectually shall rest in secure possession of the fruits; nor will they better have promoted in this respect the good of the community in general.

Whatever is the principle adopted as the basis of the Patent Laws, or may be the regulations by which that principle is worked out, the circumstances of the case require at the hands of the Government this important step:—the publication of a classified list of all the patents for inventions which have ever been granted, with a concise account of the peculiarity of each invention, to be continued by annual appendices, decenially re-arranged, and, perhaps, incorporated. A measure like this, accompanied by others of a similar spirit, would do much now, and all that could be wished in time, towards pointing out what of art and science is still appropriated, what has passed into the public domain, and what is the safe remaining field for industry and talent. The poor, but invaluable inventor, would not then complain that he had spent his strength on that which some unknown musty roll in the Record-office forbade him to touch; and ingenuity, honest and successful, would trust with cheerfulness and confidence to the law finding it to be in verity a protection and not a trap. The patent rolls would thus become the registry of all that is valuable in invention, and interesting in our social progress. But till this *is done, it seems likely* that the increas*ing pile of specifications* will only serve to conceal what inventors and the public ought to know, to render difficult of attainment the justice they rightfully require, and to give greater scope and more effectual defence to chicanery and wrong.

Thanking you for the courtesy you have shown my former communications,

I am, Sir,

Yours very respectfully,

J. CHAPMAN.

July 27, 1836.

STEAM NAVIGATION TO INDIA.

A petition of the Native and European inhabitants of Bombay, was presented to the House of Commons on the 27th inst., setting forth, that the petitioners, long and deeply impressed with the importance of establishing a rapid communication between India and England, have exerted themselves for several years past to promote what appeared to them to be the most feasible plan which has been proposed for that purpose—That the experiments which have hitherto been made, under the immediate auspices of the Bombay Government, have, as the House must be aware, been attended with complete success, and the possibility of keeping up a frequent and regular intercourse between the two countries, by means of steam-vessels, has been fully proved—That, as no such undertaking can be expected to succeed, in a country circumstanced as this is, unless the powerful support of Government be extended to it, at least, for a considerable time to come, the petitioners have been much gratified to learn that the subject had been brought under the consideration of the House; and that the Committee appointed to inquire into it had declared, by their Report of the 14th of July, 1834, that it was expedient that measures should be immediately taken for the regular establishment of steam communication by the Red Sea—That, after such a declaration, the petitioners deem it unnecessary to insist upon the importance of expediting, in every possible way, the accomplishment of the plans which have been suggested for the above purpose; yet with the prospect, which becomes daily more apparent, of a vast increase in the trade between the two countries, they may be permitted briefly to advert to a few of the many great ad-

vantages which may be expected to flow from such a measure. Depending, as the trade of India chiefly does, on British vessels for the means of transport, the importance of early intelligence in regulating the required supply, as well as for affording information of the state of the European markets, cannot, it will be obvious, be too highly estimated; and the present year, in which the increase of the staple commodity, cotton, has been so remarkable, may be cited as a striking instance of the benefit which, in a commercial point of view, it could not fail to produce, that the political no less than the commercial interests of both countries would be thereby promoted, and above all, it would materially advance the great end which England has in view in retaining her dominions over India, of extending the blessings of civilisation among the numerous population of this great empire, while it would likewise contribute in no small degree to the comfort and happiness of that large class of his Majesty's subjects whose avocations condemn them to a long sojourn in this country, with the consequent pain of separation from their friends and connexions in England. Under these circumstances, the petitioners confidently trust that the House will not fail to give the subject all the consideration which its importance so fully merits. The petitioners, therefore, humbly pray, that such further measures may be taken for improving and establishing the means of rapid communication between India and England by steam, as to the wisdom of the House may seem most expedient.

THE EUPHRATES EXPEDITION.

The lamentable event which has befallen the Euphrates expedition, in the midst of its prosperity, renders it desirable that the truth should be as widely spread as possible, that, melancholy as the facts are, reports should not increase their sadness.

The expedition, with the two vessels, the Euphrates and Tigris, was descending the river most prosperously. Fuel had become, from Beles, most abundant, consisting of wood, a bituminous coal, and charcoal. The state of the river was so favourable, that the Tigris, being the smallest vessel, was in the habit of leading, and, having a native pilot on board, there was no difficulty of finding the deep channel. The Arabs were friendly; they engaged to provide depôts of fuel, and entreated our protection.

On Saturday, the 21st inst., we had brought up at midnight to a bank for fuel, and after the people had dined we cast off, meaning to steam to Annan, then distant about eighty miles. Scarcely, however, had we commenced our voyage, when a cloud of dust was seen to rise high into the air on the right bank, threatening a squall of no ordinary violence. Preparation was immediately made to meet it, by furling the awnings, &c. Having passed over a reef of rocks, at this season far under the water, the signal was made from the Tigris, leading as usual, and having Colonel Chesney on board, to choose a berth and make fast. Scarcely had we answered when the squall began. The Tigris was rounding to make fast, the Euphrates following. As we neared the left bank I saw that the Tigris had failed to bring up—her head was falling outwards. The Euphrates was now obliged to back her paddles to give room—an operation full of danger, lest she should be unable to gather way upon herself again against the current and the violence of the gale. However, her power is great, and again working the engines with all force, she came to the bank with some violence; but by the skilful management of Lieutenant Cleveland, and the activity of Mr. Charlewood, and a most willing crew, a hawser and small anchor were got on shore; then a chain cable and larger anchor; then a second chain cable and another anchor. All the time the paddles were kept working with their utmost power. Still, however, such was the violence of the hurricane that the vessel drove, but, fortunately, it did not last above fifteen minutes, at the end of which time our danger was over and the vessel was safe.

But what had become of our consort? I had seen her cross our bows, driving down the stream, and unable to bring her head to the gale. The thick dust which then succeeded excluded her from my sight; and from that moment I have never seen her since. In the midst of the hurricane Mr. Fitzjames reported to me that he had seen her upset to leeward about three quarters of a mile, and instantly after that she went down.

A party was sent off along shore to render what assistance they could, and another went by boat. Some of the officers—namely, Colonel Chesney, Lieutenant Lynch, Mr. Eden, Dr. Staunton, Mr. Staunton, and Mr. Thompson, came walking towards us, much exhausted. They had swam and dived ashore. Some seamen and natives also followed them; but fifteen Europeans, of whom three were officers—namely, Lieutenant Cockburn, Royal Artillery; Mr. Lynch, a passenger, and brother to Lieutenant Lynch; and Mr. Sarded, an interpreter, were lost, besides five natives.

The hull of the vessel has never been found, notwithstanding all our efforts. She filled and turned bottom up. All sounding has been in vain. Some bodies have floated even so low down as this place, and have been buried.

We have since continued our voyage thus far with our former success. The officers of the Tigris saved will return to England; but the expedition continues its course with the fairest prospects.

I am, &c.
J. B. Bucknall Estcourt,
Capt. 43d Light Infantry.

Annan, on the Euphrates, May 29, 1836.

On board the Euphrates steamer, off Annan, May 26.

Return of officers and men belonging to the Euphrates Expedition who were lost on the river Euphrates, near Wordie, by the sinking of the Tigris steamer, during a violent hurricane on the 21st inst.

Lieutenant R. B. Lynch, 20th Regiment Bengal Native Infantry, passenger; Ensoff Sardel, interpreter; John Struthers, engineer.

Royal Artillery—Lieutenant Robert Cockburn, Acting Sergeant R. Clark, Thomas Jones, gunner, Robert Turner, ditto, James Moore, ditto, James Hay, ditto.

Sappers and Miners—Archibald M'Donald, private.

Seamen—Benjamin Gibson, John Hunter, Thomas Booth, Thomas Batty, George Liddel.

Natives—Aboo, Wasoo, Jacoub Johir, Manneh, Pedros.

H. BLOSSE LYNCH, Lieutenant.

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 24TH OF JUNE AND 27TH OF JULY, 1836.

Samuel Hall, of Basford, Nottingham, for improvements in propelling vessels, also improvements in steam-engines and in the methods of working some parts thereof; some of which improvements are applicable to other useful purposes. June 24; six months to specify.

Alexander Stocker, of Birmingham, for improvements in machinery for making files. June 25; six months.

John Roberts, of Prestolle, Lancaster, calico-printer, for certain improvements in the art of block-printing. June 27; six months.

Bennett Woodcroft, of Ardwick, Lancaster, for an improved mode of printing certain colours on calico and other fabrics. July 2; six months.

William Wainwright Potts, of Burslem, Stafford, china and earthenware manufacturer, William Maclune, of Burslem, china and earthenware manufacturer, and William Bourne, of Burslem, manager, for an improved method or process, whereby impressions or patterns in one or more colours or metallic preparations are produced and transferred to surfaces of metal, wood, cloth, papier machée, bone, slate, marble, and other suitable substances, prepared or otherwise, not being used or known as earthenware, porcelain, china, glass, or other similar substances. July 2; six months.

Samuel Meggitt, of Kingston-upon-Hull, master mariner, for certain improvements in anchors, and in apparatus for fishing; such improved anchors, which improvements may respectively be adapted to anchors now in common use. July 2; six months.

Robert Walter Swinburne, of South Shields, agent, for certain improvements in the manufacture of plate glass. July 4; six months.

John Isaacs Hawkins, of Chase Cottage, Pancras Vale, Hampstead-road, engineer, for an improvement in the art of manufacturing iron and steel; being a communication from a foreigner residing abroad. July 4; six months.

William Southwood Stocker, of Birmingham, mechanist, for improvements in machinery applicable to the making of nails and other purposes. July 7; six months.

Matthew Heath, of Furnival's Inn, Esquire, for new mechanical combinations for obtaining power and velocity applicable to the propelling of vessels, raising water, and to machinery of various descriptions; being a communication from a foreigner residing abroad. July 11; six months.

Elisha Haydon Collier, of East India Cottage, City road, formerly of Boston, in the State of Massachusetts, U. S., civil engineer, for an improvement or improvements in steam-boilers. July 13; six months.

Miles Berry, of Chancery-lane, Holborn, mechanical draftsman, for certain improvements in apparatus for forming staves for barrels, casks, and other purposes; being a communication from a foreigner residing abroad. July 13; six months.

Lewis Matthias Horliac, late of Paris, but now residing in the Haymarket, gentleman, for certain improvements in carriages and harness; being a communication from a foreigner residing abroad. July 13; six months.

Oliver Bird, of Woodchester, Gloucester, clothier, and William Lewis, of Brunscomb, Stroud, Gloucester, clothier, for certain improvements in machinery applicable to the dressing of woollen and other cloths requiring such process. July 13; two months.

John Ericsson, of Brook-street, New-road, civil engineer, for an improved propeller applicable to steam navigation. July 13; six months.

William Essex, of Cheetham, near Manchester, Lancaster, agent, for improvements in machinery for producing rotary motion. July 13; six months.

Samuel Brewer, of Boswell-court, Carey-street, engineer, for certain improvements for generating gas; which improvements are also applicable to other useful purposes. July 14; six months.

Charles Phillips, of Chipping Norton, Oxon, surgeon, for improvements in drawing off beer and other liquors from casks or vessels. July 14; six months.

John Ericsson, of Brook-street, New-road, civil engineer, for certain improved machinery to be used in the manufacturing of files. July 20; six months.

Charles Wheatstone, of Conduit-street, musical instrument manufacturer, and John Green, of Soho-square, musical instrument manufacturer, for a new method or methods of forming musical instruments, in which continuous sounds are produced from strings, wires, or springs. July 27; six months.

John Hall, of New Radford, Nottingham, lace manufacturer, for certain improvements in certain machinery for the purpose by such improvements of facilitating the operation which is commonly called dressing or getting up, or finishing of large pieces of lace-nets of various kinds, whereof some are called bobbin-net or twist-net, and other kinds are called warp-net and tuttings. July 27; six months.

Peter Spence, of Henry-street, Commercial-road, chemist, for certain improvements in the manufac-

ture of Prussian blue, prussiate of potash, and plaster of Paris. July 27; six months.

Charles Brandt, of Belgrave-place, Pimlico, gentleman, for an improved method of evaporating and cooling fluids. July 27; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 21ST OF JUNE AND 21ST OF JULY, 1836, INCLUSIVE.

John Woolrich, of Birmingham, Professor of Chemistry in the Royal School of Medicine at Birmingham, for certain improvements in producing or making the substance commonly called or known by the name of carbonate of baryta, or carbonate of barytes. Sealed June 23, 1836.

William Taylor, of Southwick, county of Stafford, engineer, and Henry Davies, of Stoke Prior, county of Worcester, engineer, for certain improvements in machinery or apparatus for introducing water or other fluids into steam boilers or evaporating vessels; also, for obtaining mechanical power by the aid of steam, and for communicating motion to vessels floating in water. June 27.

John Wilde, late of New York, but now residing in Manchester, merchant, and Joseph Whitworth, of the same place, engineer, for an invention, partly the subject of a communication made to them by certain foreigners residing abroad, of certain machinery for effecting the operation called knitting, and producing a fabric similar to that of knitted stockings. June 29.

David Fisher, of Wolverhampton, mechanic, for an improvement in steam-engines. July 7.

Hamer Stansfeld, of Leeds, merchant, in consequence of a communication made to him by Christian William Schonherr, of Schneeberg, in the kingdom of Saxony, for improvements in machinery for preparing certain threads or yarns, and for weaving certain fabrics. July 8.

Thomas Rock Shute, of Watford, county of Hertford, silk throwster, for improvements in spinning and doubling organzine silk. July 8.

Robert Walter Swinburne, of South Shields, agent, for certain improvements in the manufacture of plate glass. July 12.

Edward Jelowicki, of No. 8, Seymour-place, Bryanston-square, Esquire, in consequence of a communication made to him by a certain foreigner residing abroad, for certain improvements in steam-engines. July 15.

Benjamin Simmons, of Winchester-street, Southwark, engineer, for certain improvements in chemical retorts, stills, and other apparatus, and in the machinery connected therewith, and by the use or employment, whereof various processes can be speedily, conveniently, and economically performed. July 18.

John Isaac Hawkins, of Chase Cottage, Hampstead-road, county of Middlesex, engineer, in consequence of a communication made to him by a certain foreigner residing abroad, for an improvement in the art of manufacturing iron and steel. July 18.

John Archibald, of the parish of Alva, county of Stirling, manufacturer, for certain improvements in machinery or apparatus for carding wool, and doffing, straightening, piecing, roving, and drawing rolls or cardings of wool. July 21.

NOTES AND NOTICES.

Printing for the Blind.—We are happy to inform our readers that the Bristol Society for embossing and circulating the authorised version of the Bible for the use of the blind have received the munificent grant of 100*l.* from the British and Foreign Bible Society "towards printing the Scriptures for the use of the blind, by means of an embossed stenography, after the invention of Mr. Lucas." In order, therefore, that the blind may be regularly supplied with the sacred Scriptures, the type is already commenced in this city, and the Society expect to commence printing some time next month. They are, therefore, desirous that the blind should receive the instruction offered them by the Society at their school, 57, Castle-street.—*Bristol Journal.*

Bleached Flax.—We have seen this week, at Leeds, a specimen of bleached flax, prepared by a York chemist, which appears to present a decided improvement in the manufacture of that article. It has created a great sensation amongst the manufacturers, and has been taken for silk. It is capable of being manufactured into the finest thread, for veils, lace, cambric, &c., and which will supersede those articles of French manufacture. The texture is most beautiful.—*Doncaster Chronicle.*

Organ.—The city of Munich has lately purchased a curious organ of marvellous effect. The pipes and stops are of a miniature size, yet have all the musical effect of a church organ. It is the work of an humble artist of Florence, named Michael Paoli; whose talent has been revealed by chance, and who, at the age of sixteen, made a beautiful clock, after one inspection of a model. The curate of his village first employed him to make an organ, which all Florence admired.—*Athenæum.*

Philosophical Shop-Bill.—In opening, one day, a paper rolled round a pair of gloves, I discovered a lithographised chart, emblematic of society. In the north was the province of Aristocracy—in the south that of the Productive Classes. These two provinces were separated by the mountains of Pride. Among the other cantons of Aristocracy, that of the Clergy was distinguishable, watered by the river of Luxury. Below, in the territory of the Productive Classes, the rivulet of Misery fell into the lake of Despair. The most interesting part was the explanation, which gave the history of the inhabitants. Those of Aristocracy make frequent excursions into the territory of the producers, and carry off their women and children into slavery. This print sets one thinking. A privileged class, in the nineteenth century, and in a country where thought is so active as in England, should be careful to show itself intelligent and above reproach—an irreproachable power never falls.—*Hennequin's Tour in England.*

Erratum.—In. p. 264, col. 2, line 16 from the top, for "chargers" read "changes."

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C. E., is now published, price 6*d.* Also the Volume complete in boards, price 9*s.* 6*d.*

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

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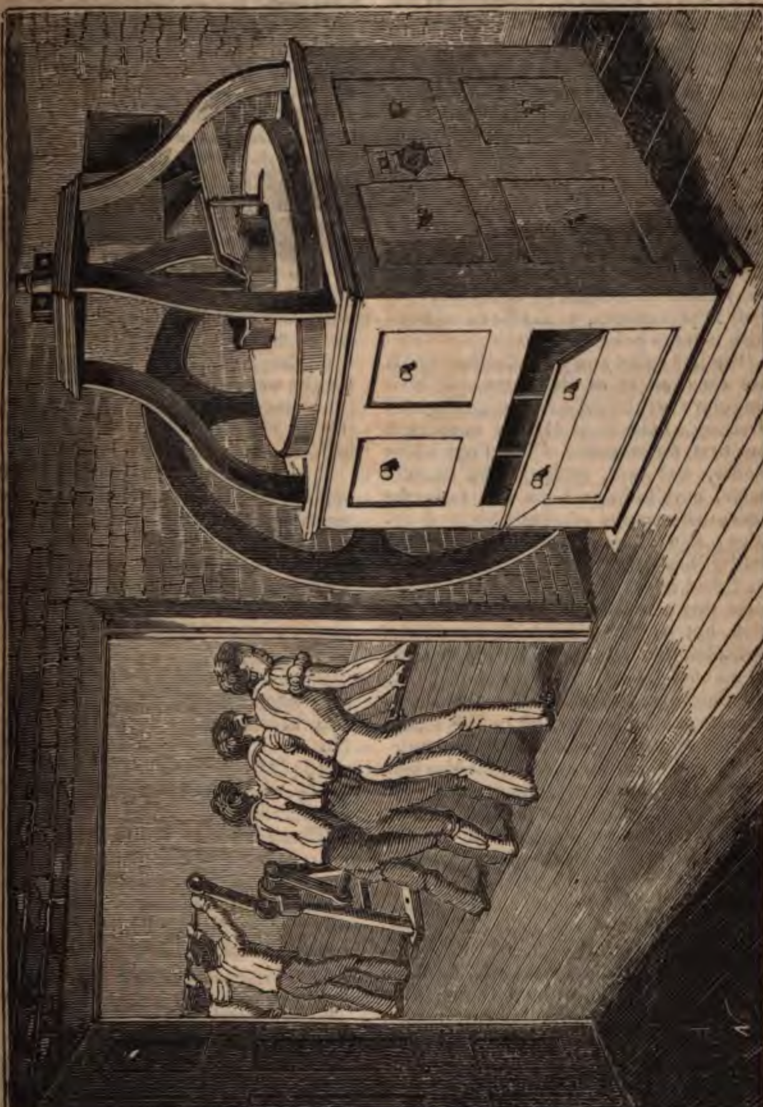
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 678. SATURDAY, AUGUST 6, 1836. Price 3*d*.



HEBERT'S FLOUR-MAKER.

HEBERT'S FLOUR-MAKER.

We fulfil our engagement made in a former Number (665), of giving a description of the larger kind of "Hebert's Patent Flour-makers;" and we adopt for this purpose, the machine which we stated was in successful operation at the workhouse of All Saints', near Hertford, in preference to another machine on the same principle, which the patentee assures us is greatly improved—because, in the first place, we fulfil our promise to the letter; and, in the second place, because the practical demonstration of actual advantages has more weight with us than any deductions from theory, however plausible. And until the inventor shall have given to us equal proofs to those which we are about to submit to our readers of the success of his more recent improvements, we shall rest satisfied with what is before us.

We live in an age when improvements are occurrences of every day, yet it is singular that the process of grinding and dressing wheat is nearly the same as it has been for centuries. The French burr stones, awkward, massive, and troublesome, have hitherto been free from the inventive assaults of enterprise and genius; and when we reflect how long the miller has been wedded to his upper and nether millstone, we can hardly expect this invention to attract his attention, but we think it a subject worthy of consideration to those who are friendly to manual labour, either as employment or punishment, to inquire how far a cheap process can be introduced in the manufacture of an article of the first consumption; and should it appear that England possesses within herself the means of effectually superseding the French burr stones, the greater honour will rest on those who are the means of its introduction.

The prefixed wood-cut exhibits a perspective sketch of the flour-maker constructed by Mr. Hebert, for the workhouse at All Saints, where it has been constantly at work, without the slightest deterioration of the grinding surfaces, for a period of time, that would, in ordinary mills, have required a renewal of them many times. For the purpose of ascertaining the efficacy of this new machine, the following questions were addressed to *the Guardians of the* Union and the Master, *to which the former* replied in general terms, that they were "satisfied with the working of the machine," while the latter answered each question categorically in the words which we subjoin.

1. How *few* men are competent to work the machine, so as properly to grind and dress?—One.

2. How *many* men can you efficiently employ in working the same?—Fourteen.

3. Can you employ *boys* equally as well as men?—Yes.

4. What is the opinion of the millers at Hertford of the quality of the flour produced?—Their opinion is, that the quality of the flour is good.

5. Do you find that the number of persons at work makes any difference in the quality of the flour or other products; or does that circumstance affect only the *quantity* of work done?—It makes no difference in the *quality*, but only affects the quantity.

6. Do you find any difficulty in making the necessary adjustments, especially as relates to the means of proportioning the work according to the number of labourers employed?—No difficulty.

7. Do you find the superintendence and management of the machine absorb much of your time?—No.

8. Has your experience in the working of the new "Patent Flour-maker" convinced you that the presumed difficulty of grinding and dressing simultaneously, is in this new machine completely obviated?—Yes.

9. Do you consider that the skill and superintendence of a regular miller is in this new machine at all necessary?—No.

10. Do you consider that the machine works as perfectly now as when first erected?—Yes.

The answer to the 9th question appears to us to be one of considerable importance, as relates to the economical working of the machine, especially in a workhouse; for in all other mills that we are informed of, the expense of a professed miller to superintend their operations is entailed upon the establishment. This is, indeed, unavoidable with the ordinary stone-mills, as their surfaces require frequent dressing or re-cutting, at least once a week when constantly in use. Besides the stoppage or loss thus occasioned of one day in every week, it requires great practical skill (at necessarily high wages) to execute such work in an

efficient manner. The wear and tear of tools and machinery is also considerable; the repairs amounting in the mill worked at Giltspur-street Compter to 20*l.* a year, and this is in addition to a miller and two assistants.

It has heretofore been deemed impracticable to grind and dress simultaneously; but we have been informed, that all the millers who have seen Mr. Hebert's machine have entirely changed their opinions in this respect, the flour produced by it being unexceptionably good; and it is perhaps worthy of remark, that owing to the grinders being entirely metallic, there is no possibility of having gritty flour from them, which is sometimes excessively unpleasant in bread made from flour produced by the ordinary mill-stones. It appears, however, from the specification of the patent, that the invention does not consist in the *material* of which the machine is formed, but lies in the mechanical arrangements, which are defined to be these, if we recollect rightly:—The grinding and dressing of wheat, or the reduction and separation of other substances, by means of a single machine, in which the grinding and dressing operations are conducted upon one continuous surface; or wherein the meal, as it is projected from the circumference of the grinders, is received into a sieve whereon it is dressed. The patentee seems to give the preference to metallic surfaces on the ground of his having made great improvements therein, especially as relates to the easy means afforded of giving the grinding surface an unusual degree of truth; and that kind of roughness which so nearly approximates to the French burr-stone, as he expects will lead to the entire abandonment of the latter. An example of the application of burr-stones to these patent "flour-makers" is, however, given in the specification, as the invention equally embraces them.

It has long been anxiously desired by philanthropic legislators, that a substitute might be found for the horrid and degrading punishment of the lash. Now, we are strongly impressed with the idea, that a machine of this kind, but of the size described in our previous Number (665), is admirably adapted to effect the object in view, as the offender might thereby be easily made to atone in *confinement for his offence,* by grinding a *given quantity of corn,* as the condition of his liberation—say, for instance, a bushel for getting drunk, a sack for insubordination, and so forth.

ON AEROSTATION.

Mr. Editor,—If the following remarks possess sufficient merit to entitle them to a place in your popular Magazine, a weekly peruser of it will feel happy at seeing them inserted in one of your forthcoming Numbers, in the hope of their drawing to this wonderful art the attention of some more opulent, learned, and scientific person than

Yours, &c.
OMRI.

Upwards of half a century has elapsed since the introduction of aerostation; essays on which have from time to time appeared in the *Mechanics' Magazine;* but although I differ in opinion with most of the writers of those essays, particularly the *bird-fancier*, I shall not here make any remarks upon their lucubrations, controversy not being my object, but a desire to ascertain the cause—Why, when almost all other arts and sciences are progressing towards perfection, the *art of flying* remains stationary? Every succeeding attempt is limited to merely ascending and descending where and how the adventurer best can, not where he would; all his other movements being "the sport of winds—scorning the guidance of man." Is there any sufficient reason why the art of voyaging in an element far less dense than water, should not be performed with the same precision, safety, and rapidity, as on land or water?

A paragraph lately went the round of the papers, and appeared in your Number of April 16, stating, that Dr. Amge had read an essay at the French Institute, endeavouring to prove that balloons might be guided by means of oars inflated with gas used in the car; but as I consider this to be merely a renewal of Montgolfier's attempt, with very little amendment, I shall only here remark that, if I understand the learned professor rightly, such a contrivance cannot answer the purpose; that is, if he means after the manner of a boat towing a ship, because a boat to tow a vessel or raft must be placed on a line in *advance* of the object to be towed. Now to effect this, either the car must be elevated from

its present position, or the balloon must descend to a level with the car; but how either could be retained in such a position, I am at a loss to conjecture; I should as soon expect to see a ship steered by the rudder of a boat that was towing at her stern, as to witness a balloon, driven, perhaps, by a strong current of air, guided by any puny effort that could be made in the car.

I come now to inquire into the failure of the practical aeronauts of the present day (one of whom is said to have made upwards of two hundred ascents), who, with improved materials of every description, appear to have profited nothing by experience—balloons being now as nearly similar as two things can be to what they were when first invented. Mr. Green, who manufactures his own cloth, has, indeed, announced his intention of making a balloon of sufficient capacity to carry up ten persons. This enlargement appears to me to be neither more nor less than an expensive perseverance in misconstruction; for, viewing it in a homely light, who would feel disposed to extol the abilities of a housewife competent to make a pudding for two persons, because, on being furnished with a sufficiency of materials, she made one capable of satisfying ten? Nevertheless, no one can deny but that courage, perseverance, and expense, have been displayed in the cause. All that has been wanting to the complete success (probably) of the art of flying, is a little of the same inventive or creative faculty to which we owe the steam-engine, the power-loom, and a hundred other valuable improvements.

After a repetition of descriptions, such as we have been favoured with by aerial voyagers for the last fifty years, viz. a view from the clouds of the striking beauties of boats, bridges, and buildings; canals, churches, and crowds; docks, ditches, and drains; ruts, rivers, and roads; vessels, verdure, and valleys, such views as any person may parallel when he pleases, by ascending St. Paul's or the Colosseum, we come to the important announcement, that Mr. Graham is about taking out a patent for a navigable balloon. I have considered this for the last twenty years to be decidedly practicable, *and, therefore*, shall not, without *seeing Mr. G.'s specification*, or what *would be still more gratifying*, the balloon itself, attempt to dispute or deny the efficiency of his plan for the end proposed; but, in the absence of ocular demonstration, I have no hesitation in pronouncing it an impossibility, unless the present globular shape of the machine be altered.

Balloons, as the name imports, were at the first made globular, that shape being considered as best suited for containing the vast quantity of gas supposed to be necessary for raising the required weight. As soon, however, as it was ascertained that 2,500 cubic feet of gas were sufficient to raise a weight of 125 lbs. that quantity, and as much more as was barely necessary to raise the balloon and its appendages, should have been compressed into a different shape; but this has never yet been attempted. The same unmanageable shape has only been enlarged to gratify curiosity or conceit, and a desire to obtain the repayment of expenses, has hitherto blasted the hopes of science. To point out more clearly the folly of attempting to make a circular machine manageable, let us suppose the body and wheels of a coach placed on and around a circular carriage, would it not be difficult to procure a driver sufficiently skilled to know what part of the carriage to harness his horses to, so as to give it a progressive motion, without dragging it bodily against all the rules of art? Or if a globular ship had been built, and the management of her entrusted to Drake or to Cooke, would they not have found her more inclined to turn upon her own axis than to any given point of destination?

Should the foregoing remarks meet insertion, I may be tempted to trespass again upon your pages with a few more remarks upon this interesting subject while the mania for it lasts, which now appears to rage in London.

OMRI.

London, August 1, 1836.

LOCOMOTIVE-ENGINE EXPERIMENTS.

Dear Sir,—Should you agree with me that the following fact will be useful information to your readers, you will oblige me by giving it an early insertion in your valuable publication.

Some time ago, while experimenting on a small locomotive model, I found that the application of power in the

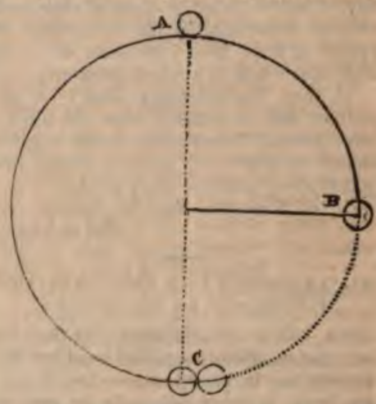
double-stroked locomotive steam-engine, with cylinders laid horizontally, is, contrary to the opinion of most engineers, very different in every other stroke; that is, when the piston is propelled forward, in the direction in which the carriage is moving, the force of the steam is communicated to the wheel by the piston-rod, and, of course, produces *angular motion*. But on the next stroke, or return of the same piston, the cylinder itself, by the pressure of the steam on the end flange towards the front of the carriage, propels the carriage in a right line forward, and leaves the piston behind the whole length of such stroke; but as the piston-rod is connected to the crank of the axle of the wheel, it (the piston) is brought home to its situation again by the wheel every other stroke.

These considerations will fully show, that the application of the power of our present double-stroked locomotive-engines is not, at the present day, understood. For it is evident, that the force of steam is differently applied each succeeding stroke of the engine: one stroke of the engine applies the force by the piston-rod to the wheel; while, in the other stroke, the force is applied, on the rocket-principle, by the cylinder becoming the propeller, as before stated; and these different applications of force are necessarily productive of very different effects—the one producing *angular* or *central*, and the other decidedly *rectilinear* motion. From this discovery it becomes a matter worthy the serious consideration of all railway engineers, to draw a comparison betwixt these two applications of power, in order to prove the difference of their respective effects.

The first law of motion laid down by Sir Isaac Newton, is in the following words:—" Every body perseveres in a state of rest or of uniform motion in a right line, unless it be compelled to change that state by forces impressed thereon." This is fully corroborated by more recent writers.

Dr. Young has the following remark on the subject of angular motion:—" When a body is retained in a circular orbit by a force directed to its centre, its velocity is every where equal to that which it would acquire in falling by means of the same force, if uniform *through half the radius*, that is, through *one-fourth the diameter*. This proposition affords a very convenient method of comparing the *effects* of central forces with those of simple accelerating forces, and deserves to be retained in memory."

My method of coming at this comparison experimentally, was as follows:—I



described a large circle upon a wall sixteen feet high, and fixed a pin in the centre, having drawn two lines across the diameter through the centre, at right angles to each other, I then took two balls (ivory billiard balls) of equal size and weight; to the one ball a silk thread the length of the radius was attached, and the other end of the thread was tied round the pin in the centre of the said circle. One of the balls A was placed at the top of the circle, and the other, B, attached to the thread at the horizontal line level with the centre; and when both were let fall at the same instant of time, they invariably met at the bottom of the circle, striking at C every time the experiment was tried. Now it is evident that the ball A falls with free motion in a straight line, while the ball B, by the string being attached, is confined to move in a circular orbit, and produces angular motion. And when we compare these two applications of force (*both acted upon by gravity*), it is clearly proved by the foregoing experiment that a body A in free motion in a straight line falls through twice the perpendicular height that the body B does in the same time; the latter being subjected to angular or confined motion, while the former A falls freely in a straight line, and consequently produces rectilinear motion. In order then to com-

pare these two velocities with each other, the velocity of A will be $\sqrt{64 \times 16} = 32{\cdot}0000$; the velocity of B will be $\sqrt{64 \times 8} = 22{\cdot}6274$. These quantities, therefore, as the quantities of matter are equal in both, must represent the quantity of motion or momentum of each, and clearly demonstrates the advantage of applying force in a rectilinear direction over that which is applied circularly.

If, then, the foregoing theory be admitted, and of which I have no doubt, our present locomotive steam-engines should be altered, in order to render this principle of avail at every stroke.

I remain, dear Sir, yours,
PRACTICUS.

MR. SYMINGTON'S PLAN OF CONDENSATION ANTICIPATED BY MR. HOWARD.

Sir,—It is right to state that the plan of condensation communicated by Mr. Symington in your last number, is precisely the same in principle or method as that for which I obtained a patent several years back; being, as stated in my specification, "essentially the withdrawal of the warm water from the vessel or vessels in which the vapour is condensed, and injecting it again amidst the vapour, the heat in the mean time having been abstracted from it." Whether this is effected by passing the water of injection through a copper worm coiled around the condenser, and lying in a cold water cistern within the frame of the engines, as in my steam-vessel, the Vesta, and shown in the drawings attached to the specification, or by passing a pipe along the ship's bottom, as proposed by Mr. Symington, is quite immaterial. These latter not being new in themselves, are not matters of invention, but of arrangement merely.

I may add, that the process answers completely, and that Mr. Symington himself saw it in operation at the King and Queen iron-works, Rotherhithe, upwards of two years ago. The principal advantage resulting from this form of condensation over that by external cold applied to the steam itself, is the great reduction of the size, weight, and expense of the apparatus. In the former the liquid is *slowly* cooled by passing *along the pipe or other surface*, and the *steam instantly* by the injection. In the latter the steam is, or rather perhaps is attempted to be, instantly cooled on the surface, which must therefore be very extensive. The water of injection may be cooled at leisure as it were, and with a moderate surface; but the steam, in order to obtain a due effect on the machinery, *must* be cooled instanter.

I am, Sir,
Your most obedient Servant,
THOMAS HOWARD.

London, July 30, 1836.

THE PATENT LAWS.

Sir,—As there is likely to be ere long some alteration in the law relating to patents, it will perhaps not be thought out of place if I should, through the medium of your valuable journal, make known an idea that has occurred to me on that subject for the greater protection of patents taken out for small machines, such as pencil-cases, pens, &c. If the patentee of the improved pencil-case were to attempt to punish all those persons who have encroached upon his right of patent, it would occupy him years, and then he would not be safe, for others would immediately commence making them again; and this, in my humble opinion, will always be the case while such unprincipled men find customers ready to purchase them. Now, the simple plan I have to propose for the consideration of the framers of the new patent law is this:—That every patent machine shall have the patentee's name in full, and also the date on which the patent was taken out, written on some conspicuous place; this being done, a heavy penalty should be inflicted upon all persons purchasing, or having in their possession,* patent machines without the above mark.

Trusting you will not deem the above remarks unworthy your attention,

I beg to remain,
Your obedient servant,
DAVID SMITH.

Leamington, Eagle Foundry,
June 8, 1836.

* When the machine does not admit of the name of the patentee and date of patent being attached to it, the penalty should extend to all persons selling or offering for sale the same without the authority of the patentee, which written authority should be placed in a conspicuous place in the shop where patent articles are sold.

MAGNETO-ELECTRIC APPARATUS.

Sir,—As it is my intention to construct a magneto-electric apparatus similar to the one represented and shortly described by Mr. Rutter, in No. 560 of the *Mechanics' Magazine*, I should feel particularly obliged to that gentleman (or any other of your correspondents who *possesses* such an apparatus,) if he will describe more fully the various parts belonging to it. I should not thus intrude, but that it appears to me to be an apparatus requiring considerable nicety of adjustment; as I know a gentleman who has constructed one, in which the compound magnet is very powerful, but which is, nevertheless, quite inactive: I infer from this that the size of the armature, and the length and size of the copper wire forming the helices, are of considerable importance. He will confer an additional favour if he will inform me how the decomposition of water is effected by this apparatus.

I remain, Sir, yours, &c.

G. S.

Birmingham, May 22, 1836.

BRITISH MUSEUM.

The following petition was presented to the House of Commons on the 2nd inst. by the *Chancellor of the Exchequer*, and we trust it will be the means of securing to the world of literature and science that access to the treasures contained in the British Museum which a good *classed catalogue* alone can afford, for it would be futile to institute a comparison between this and a mere alphabet of names.

To the Honourable the Commons of the United Kingdom of Great Britain and Ireland in Parliament assembled.

The humble petition of John Millard, of Arlington-street, Camden Town, London,

Showeth,

That by certain returns presented to your honourable House in the year 1833, it appears that there were in the year 1832, 218,957 printed books, 21,604 volumes of manuscripts, and 19,093 charters in the British Museum.

That several petitions have been presented to your honourable House during the present session, signed by many distinguished scholars and scientific persons, praying your honourable House that a classed catalogue of these treasures might be printed and published in a convenient form and at a reasonable rate.

That, in the opinion of your petitioner, such a work would be a boon conferred on the world of literature, is indispensable to all who are engaged in literary or scientific pursuits, and is infinitely superior in point of utility to any *alphabetical* catalogue that could be formed of the books and manuscripts.

That Mr. John Murray, of Albemarle-street, at the suggestion of your petitioner, has offered to print and publish, at his own risk, classed catalogues of the books and manuscripts in the Museum, if printed in octavo and sold in parts, and that by this means many thousands would be saved to the public.

That your petitioner has witnessed with the deepest regret, that in the report of the Committee appointed by your honourable House to inquire into the condition, management, and affairs of the British Museum, printed among the votes of your honourable House of the 14th inst., there is no recommendation to your honourable House on the subject of classed catalogues, nor any notice of Mr. Murray's offer.

That your petitioner has reason to believe that an *alphabetical* catalogue of the printed books is now in course of preparation, and that it is the intention of the Trustees of the Museum to print this catalogue at the national expense, probably amounting to some thousands of pounds, to the exclusion of a classed catalogue, which might be printed and published without any demand on the public purse.

Your petitioner, therefore, humbly entreats your honourable House, that your honourable House will be pleased to direct the Trustees of the British Museum,

1. *Not* to print the alphabetical catalogue of the printed books now in course of preparation, which in your petitioner's opinion would not pay a tithe of its expenses, which no bookseller would undertake the risk of publishing, and which would be comparatively useless to the public.
2. To resume and complete the classed catalogue of the printed books, the preparation of which it appears, from the annual accounts of the Museum, has already cost the nation more than 5000l., and to enter

into an agreement with Mr. Murray to print and publish the same at his own risk.

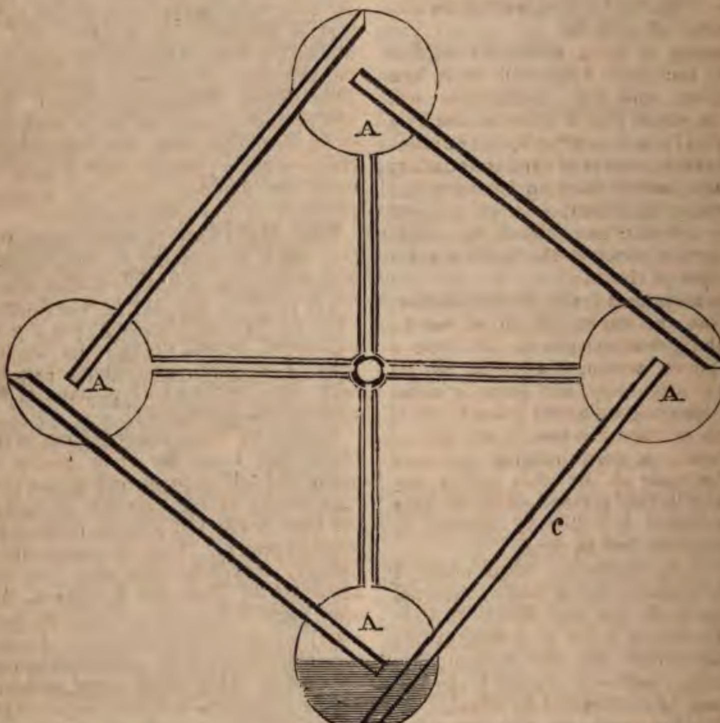
3. To prepare a classed catalogue of all the collections of manuscripts, and to print and publish it in the same way.

And your petitioner will ever pray, &c.

JOHN MILLARD.

July 28, 1836.

JONES'S ROTARY MERCURIAL STEAM-WHEEL.



This wheel consists of four cylindrical iron vessels, marked A, with a suitable opening at one end for the rectifying of the valves, &c., and capable of holding between one and two hundred weight of mercury. Four tubular spokes communicate from the axle to the cylinders. The axle is hollow and fixed, and the wheel revolves around it. The axle has also a circular opening in it of the same diameter as the spokes. It has also four other tubes, marked B, with a valve at the extremity of each, furnished with a spring of just sufficient elasticity to keep the valve closed. The three groves marked in the axle communicate with the centre of the wheel and the atmosphere, and are so contrived that no compressed steam can exist in the three upper spokes and cylinders. I have also a plan for condensing the remainder, and producing a vacuum.

Mode of Action.—In the prefixed figure, one of the spokes is now open to the hollow axle, and opposite the hole in the axle, which can only be the case when one of the spokes reaches the true perpendicular. The steam then rushes into the lower cylindrical vessel, and drives the mercury 112 lbs. up the pipe, C, into the next cylinder, A; that cylinder then descends, and when it has reached the perpendicular, the steam descends, and the mercury is driven into the next tube, and so forth. The waste

steam escapes by the plan before laid down.

The Power of the Wheel.—The diameter of the wheel is four feet, and the diameter of the axle three inches. Semi-diameter of the wheel 24 inches, of the axle $1\frac{1}{2}$ inch $24 \div 1\frac{1}{2} \times 112$ the weight of mercury in the ball, *e*, $= 1792$ lbs. minus 12 lbs. for friction, leaving a working power of 1780 lbs.

Quantity of Steam used.—As one foot will fill each ball, 4 feet will make one revolution, and nine revolutions will wind up seven feet of rope on the axle ($3 \times 1{\cdot}1416 \times 9 \div 12 = 7$). The number of revolutions made and the quantity of steam used to draw up 1780 feet 112 fathoms, or 672 feet, $112 \times 6 \times 7 \div 9 = 864$ revolutions; $864 \times 4 = 3456$ cubic feet of steam used, or 445 lbs. for every foot of steam.

Advantages.—In the present engine, on Watt's principle, the steam has an absolutely dead weight to lift from a dead point, accompanied with all its massive machinery, and there is accurately speaking no power gained; for if we wish to raise five tons at one end of the beam, a corresponding pressure must be made on the other end or piston; but in the present wheel we have only to raise 112 lbs. to increase its power nearly sixteen times.

The only mercurial steam-wheel I can get any account of was one erected by Messrs. Bolton and Watt, on Cardrew Downs, to drive a turning lathe; but the motion was not circular, but alternating, and was rendered circular by means of a crank and fly wheel.

I wish for some one who has got a spirit of mechanical inquiry and speculation to give the wheel a fair trial, and shall be happy to give him all the information that lies in my power. The wheel is *pro bono publico*.

The insertion of this in your valuable publication will oblige a subscriber and zealous promoter of your Magazine.

William Jones.

Chacewater, near Truro.

MACKINTOSH'S ELECTRICAL THEORY OF THE UNIVERSE.

Sir,—Your correspondent Kinclaven has *undertaken "to correct* a mistake *which," he says, " Ursa Major* has fallen *into." Kinclaven is very* kind to Ursa Major in thus tendering his services voluntarily and gratuitously to " pull the mote out of his brother's eye," &c. He tells us, that " Laplace has demonstrated (in the 1st and 4th books of the *Mechanique Celeste*), that when the sun and moon cause the ocean to swell to places under them, there is also a high tide at the same time in that part of the ocean that is diametrically opposite; and all this he has done in strict accordance with the principles of universal gravitation." That Euler, Maclaurin, Daniel Bernoulli, and " every writer of eminence in physical astronomy, has demonstrated the same thing; and all their demonstrations are founded upon the unerring principles of universal gravitation."

Ursa Major begs to assure Kinclaven that he is no stranger to the aforesaid demonstrations, and is of opinion that if he, Kinclaven, can any how manage to translate them into the language of common sense, he will do more for the doctrine of universal gravitation than has been done by the whole phalanx of demonstrations put together.

It may be unnecessary for me to remark, that I am far from giving an entire and full acquiescence to the electrical theory of the universe, at least in the form in which it presents itself to my mind at present. I am, however, still of opinion, notwithstanding what has been advanced by Zeta and Kinclaven, that some parts of this theory carry with them a very strong air of probability. In fact, the objections of these gentlemen amount to nothing. They have given authority for their opinions, it is true, but no argument; this will not do at the present day; one solid argument will go farther with the present thinking, searching generation of men than a thousand authorities.

It appears, Mr. Editor, that this *new philosophy* is making its way somewhat rapidly. In passing a public lecture-room in the neighbourhood of the City-road, a few days ago, I observed an announcement that a lecture would be delivered on the Electrical Theory of the Universe, which I had the curiosity to attend. The lecturer, a Mr. Thorne, I believe, a young gentleman who appears to possess talent and attainments of an eminent order, treated the subject in a manner which at once reflected great great credit on his own capacity and the

theory he had undertaken to illustrate; and his expositions were received with evident marks of approbation, by what appeared to me a highly intelligent audience.

I remain, Sir, yours, &c.,
URSA MAJOR.

CASTING AND GRINDING SPECULA.

Sir,—In February, 1830, being wishful to obtain information in the art of casting and grinding specula for reflecting telescopes, I took the liberty of addressing you, in the expectation of receiving information on this subject from some of the practical correspondents to your excellent Magazine. However, in this I was disappointed, but in a subsequent volume it was promised, in answer to another correspondent (vide vol. xv. p. 271), to republish a curtailment of Edwards's treatise on that subject, as containing the best directions up to that time published, and which was generally followed by persons undertaking the construction of these instruments. I take for granted this intention was laid aside in consequence of Mr. W. Ettrick (vol. xv. p. 335,) promising to describe (by what method, is left in doubt,) a new discovered process of his own, completely superseding the old methods, and by which success was sure, and the whole processes of casting, &c. was completely freed from the uncertainty hitherto connected with them.*

Now, sir, as five years have since elapsed, and no tidings of Mr. Ettrick's discovery yet announced in your pages, I trust the want of patience will not be laid to my charge by thus calling upon him to fulfil his promise, if his subsequent trials and experiments have verified his theory.

It is scarcely necessary to state, that I have spent the whole of my leisure time, during a period of ten years, in prosecuting a series of experiments, and must confess, have theorised and practised in vain, finding that I am not much nearer perfection than at the commencement; in finding a certain method of casting free from surface defects and porosity of metal, my experience teaches me to think little or nothing of the difficulties in figuring and polishing in comparison with those of the casting free from defects, before enumerated.

By drawing the attention of Mr. Ettrick and your numerous readers to this subject, I shall feel particularly obliged.

I am, Sir,
Your obedient servant,
C. G.

Gateshead, July 14, 1836.

P.S.—Perhaps Mr. Ettrick would favour your readers with a drawing and description of his instrument mounted for use, as there is a scarcity of such in mathematical works.

* Our correspondent conjectures rightly. If we *do not ere long receive Mr. Ettrick's* long-promised *communication, we shall still* publish an abridg*ment of Edwards's treatise.*—ED. M.M.

THE CHAFFINCH.

Sir,—To such of your numerous intellectual readers who take pleasure in the study of nature in the fields and woods, the following fact may prove interesting.

This day week, I think it was, it blew almost "a gale of wind." A chaffinch's nest, placed near the top of a high horse-chestnut tree in the front of the house, was damaged, and one of the young nearly able to fly, came to the ground, and I caught it. It was old enough to eat of its own accord; and, until this morning, I kept it perched on a hencoop at the back of the house. This morning it had, somehow or other, contrived to get into the roof of a barn, and while I was attempting, by means of a clothes' pole, to get it down, and being surrounded at the time by four or five other persons (children) who were, of course, making a great outcry, for fear of the little orphan inmate being lost—the mother flew down straight from the other side of the house, and, without the least hesitation, seized her little one by the leg, and carried it off, over the house, to the top of the high tree from which it had fallen a week before! I look upon this as rather a curious circumstance of the kind; the power of wing in the old bird is not the least remarkable of its interesting features. I have the honour to be,

Sir, yours, &c.
F. MACERONI.

June 16, 1836.

RISE OF A CITY IN THE WILDS—AN AMERICAN PICTURE.

(From the *New York Journal*.)

A recent visit to Lowell, Mass., has affected me with much surprise, and afforded a high gratification. Extraordinary it may well be called, for here is a city at its maturity at the age of twelve years; here is a spot which seemed almost doomed to perpetual sterility, teeming with wealth; and in that short space the residence of a few straggling farmers, gathering, by severe toil, a scanty subsistence for themselves and their cattle, from an uncongenial and pernicious soil, is transformed into a busy and buzzing hive, with a population approximating twenty thousand, active with impetuous spirit of industry, stimulated by rapid returns of profit, taxing to its utmost speed all the powers of mechanical genius, and labour-saving art; and with a thirst for knowledge and improvement, which seems to gather quickness from sympathy with the movements of the machinery around them, erecting halls, laboratories, libraries, and cabinets, for the cultivation of science; and thus laying a broad foundation for intellectual improvement.

The moral spectacle here presented is in itself beautiful and sublime. The machinery of one of these great mills is not an unapt picture of society. Here are wheels within wheels; bands circling within bands; threads crossing threads; numerous and almost infinitely varied operations going on at the same time; much that is seen, and much that is unseen; mighty and concealed powers working in their subterraneous abodes with a tremendous agency, and sending out their influences to places far remote from their presence; human ingenuity strained to its utmost power, and human care equally concerned in the constant superintendence of this complicated apparatus; the powers of the physical world called into efficient action, moulded, guided, and brightened under the sharpened activity of intellect; the moral every where intermingling in order to preserve harmony and secure the fidelity of the intellectual and physical powers; and all, in all its parts and operations, all resting upon an *unseen agency, whose activity is every where detected, but whose power is utterly unmeasured*, and the mode of whose operations the brightest philosophy has not even conceived; all resolvable into one simple and great law, the law which pervades the whole material creation; hold fast the dust of the balance, the atom floating in the sunbeam, and the mightiest orb which brightens in the firmament; all, where each part retains its place, performs its duty and supplies its contribution, moving on in a beautiful harmony; producing results largely subservient to human comfort, improvement, and pleasure. On the other hand, all these results are defeated, when even the most minute and the humblest part of the machinery fail to perform their proper office; determine to go wrong, or refuse to go at all; when the wheels cease to revolve, or the filaments become broken; or the combination of physical, intellectual and moral energy, felt in a thousand hands, beaming from a thousand eyes, and operating in a thousand hearts, is broken up, withdrawn, relaxed or perverted. Now, this is a striking analogy of human society; this is a world in miniature. Laws bearing a strong resemblance to each other prevail in both. They are universal laws; they are uncontrollable and unalterable to human power or pleasure; they are ceaseless in their operation; and, like the great Being who established them, they are "without variableness or even the shadow of change."

Lowell is principally devoted to the manufacture of cotton; but it embraces several other important factories; very extensive woollen factories, for flannel, broadcloth, kerseymere, worsted, and carpeting; extensive machine shops for the construction of various kinds of machinery, from that necessary to the furnishing of a cotton mill to railroad cars and steam-engines; together with a card and whip factory, planing machine, reed machine, grist and saw mills, glass works, iron furnace and powder mills, and extensive bleacheries and print works; in all, employing a population of nearly eight thousand operatives, to say nothing of the persons subsidiary to their support and accommodation, and a capital of nearly nine millions of dollars.

The mills in general are of a large size; generally of brick, and seven or eight stories in height, well lighted, ven-

tilated, and warmed. The machinery seemed of the most improved and perfect kind; and in general, and as far as the nature of the occupation admitted, the neatness and order of the mills which I visited, most exemplary. The hours of work, exclusive of meals, average about twelve; and, as far as I could learn, it was the determination of the overseers never to employ children under twelve or thirteen years of age; and none such were employed, except where parents, as in the block printing, where they work by the piece, chose to avail themselves of their children's aid in some of the subordinate operations. The e cases were almost universally those of foreigners. They were discountenanced by the superintendents; and in my opinion, where there are schools to which such children might be sent, it ought to be made a penal offence by the statute; or in any event never more than three hours' labour in the twenty-four should be exacted from them.

The cotton fabrics made here are of various qualities; the finest averaging about 42 or 45 hanks to the pound. The printing establishments, by means of engraved copper cylinders, where sometimes four impressions are given by a single revolution of the machine, are well worth visiting; and the machinery for engraving these cylinders by the sinking of steel dies is very curious, and capable of being graduated to the thirty-six thousandth part of an inch. This is almost litterally splitting a hair. The invention and delineation of the figures displayed great ingenuity and skill. The shearing of the woollen fabrics is a delicate and beautiful operation; but the singeing of the fine furze or nap of the cotton cloth, by dragging the piece of cloth directly over, and in contact with, a red hot iron cylinder without burning the cloth itself, strikes an unaccustomed eye with extreme astonishment. The card and whip factories are exceedingly curious, and as automatic machines approach nearer to the actual operations of intellect and intelligence than any one who had never seen them could imagine to be possible. Both these machines, we understand, were of domestic invention. The rapidity of the operations in almost every department of manufacture which I visited was a remarkable circumstance. A large whip was completely braided with cord in about five minutes; and the superintendent of one of the establishments informed me that he turned out one piece of cotton cloth of thirty yards in about every minute and a half, while his works were in full operation.

The standard of health among the operatives in the factories, as I learnt from the best medical sources, was considered as good. Many persons on going into a new place, and into new and different employment from that to which they have been accustomed, generally suffer at first, and pass through a kind of acclimation; but afterwards they enjoy as good health, and in some cases the health has been improved, as before entering the mills. It is obvious, however, that some of the processes must be less favourable to health than others; as there are, doubtless, predisposing causes to disease in some, which do not exist in other temperaments or constitutions.

Of the moral character of the present manufacturing population of Lowell, I feel authorised to speak in high terms. I was permitted to look in some cases at the books, in which the names of the individuals employed are recorded; and if they are discharged, the causes of that discharge are mentioned. The instances of discharge for improprieties of conduct were comparatively very few. The regulations for enforcing decorum and order are strict; and the character of the present superintendents of these establishments, such as to afford an ample guarantee that all which can be done shall be done to secure the good conduct and virtue, and to promote the comfort of the young persons under their employ. These gentlemen acting with such a powerful influence as they necessarily exert, it is obvious, hold a highly responsible situation. The virtue and welfare of many thousands of very susceptible beings rest upon what they do or what they fail to do: and as long as they rate the value of moral character so highly, and insist upon moral correctness, as indispensable to their patronage, and encourage sentiments of high self-respect among the operatives themselves, they certainly will do much towards securing the moral purity and advancing the moral improvement of these interesting communities. It was delightful on Sunday morning, at the first sound of the bell, to see the multitudes of well-dressed young people crowding into the Sunday school, and into the

house of God; and it was a circumstance of peculiar gratification to learn, that more than three hundred of these young persons were communicants at one of the churches in that town. The congregating of such vast numbers of young people removed in general from the restraints of home, presents, it cannot be denied, great perils to virtue. The manufacturing districts of old countries have long been stigmatised as places of most flagrant licentiousness and immorality. The character of our population is essentially different from that of the places referred to. Our manufacturing population have in general had the advantages of careful domestic training, and a good school education. They are not manufacturers for life; but design to remain only long enough in the mills to get the means of a settlement in life. They have undoubtedly, the greater part of them in New England, been blessed with a religious education; and they are looking forward to rise in life, and feel the high worth and indispensable importance of character every where among us. These circumstances cannot fail to operate most favourably among them; and their beneficial effects are instantly to be seen. Whether they will remain sufficient will be matter of just concern with every benevolent mind.

Much is done likewise for their intellectual improvement. Frequent and most valuable courses of scientific lectures are given,—to which access is made easy by the payment of a very small fee. A social library and reading room are established likewise, on the most liberal principles; and a chemical laboratory and a splendid mineralogical cabinet have been procured. We have never been in a community where the spirit of inquiry seemed more active, or found more patronage and encouragement.

Add to all this, that great instrument of virtue, of comfort, and of the amelioration of the condition of the poorer and labouring classes, the savings' bank is in full operation among them; and here, as in every case where it has been tried, has produced the most salutary effects; the deposits amount to 200,000 dollars, and promise to be greatly extended—a great proportion of the depositors being found among the young women engaged in the establishments. The perfect *security of the wages of labour,* is among *the most efficacious protections* of human virtue; and a powerful encourager of industry, frugality, and temperance—virtues so important to individual character and comfort, and to the general welfare of society.

HENRY COLMAN.

RAILWAY PHRASEOLOGY.

Sir,—In a contemporary journal, there appears a violent tirade against the word *gradient,* as at present used amongst civil engineers; and a facetious attempt is made by assigning to it an Hibernian origin, to drive it out of our vocabulary by the force of ridicule; it is moreover called barbarous; said to be misapplied, &c. &c., all which joined to the late introduction, or invention of the word *clivity*, adopted in the translation of Navier seems to challenge a discussion of the comparative merits of the two words.

Gradient is derived, if I mistake not, from the Latin *gradus*, a step, and is, therefore, not inaptly applied to express "the character of a road throughout its entire length taken step by step," as it comprehends all kinds of surfaces both hilly and level; but *clivity* being plainly deduced from *clivis*, a hill, is, though a good general term for ascents, and descent by no means applicable to *levels*, or any thing approximating thereto.

Again, in a note in the same publication, there are some remarks on the use of the word *terminus*, which I think perfectly absurd. Beginning and end cannot be properly applied to the termination of a road, for people will commence their journeys at which ever point best suits their convenience. I think it would puzzle the writer to determine which is the *commencement* of the railway between Liverpool and Manchester.

Perhaps it would be well to substitute the plain English word *termination* for the Latin *terminus*; but it is surely better to retain a correct word through a dead language, than to displace it only to make room for an incorrect one in our own, the unsuitableness of which, would on that very account, be the more easily and generally detected.

I should not have troubled you with these observations but for the dogmatical, dictatorial style of the article alluded to, which appears besides in a work that pro-

fesses to give lectures on precision in scientific terms.

Your obedient servant,
Q. Briggs.

July 7, 1836.

CAPTAIN S. BROWN'S METALLIC LIGHTHOUSES.

(From the *Scotsman*.)

It has been proposed to place a lighthouse on the Wolf Rock, near Land's End, a position where it would be exposed to the most violent storms of the Atlantic; and a plan was drawn up for the purpose by Mr. Stevenson, who holds a high rank in this department of engineering; which plan, Mr. Brown thinks, would require fifteen years for its execution, and cost 150,000*l.* Mr. Brown undertakes to erect one of bronze, 90 feet high, which would answer the purpose as well as the stone one of 134 feet, for 15,000*l.*, and to complete it in four months. Lighthouses are generally of masonry, the outer stones clamped with iron, and in large blocks, to lessen the number of joints. The one on the Eddystone Rock, near Plymouth, erected by the celebrated Smeaton, is 24 feet in diameter at the base, and 90 feet in height, of which 72 consists of solid masonry. That built by Mr. Stevenson on the Bell Rock, near Arbroath, is 40 feet in diameter at the base, and 110 feet in height, of which 102 consists of solid masonry. The defects of such a structure are obvious. In the first place, it consists of some thousand pieces; and, among as many thousand joints in it, a few faulty ones would be fatal to its strength. Secondly, its great breadth presents an enormous surface to the action of the winds and waves. Mr. Brown estimates, from experiments made by him at the extremity of Brighton Chain Pier in a heavy south-west gale, that the waves impinge, on a cylindrical surface 1 foot high and 1 foot in diameter, with a force equal to 80lbs.; to which must be added that of the wind, which, in a violent storm, exerts a pressure of 40lbs. He computes the collective impetus of the wave on the lower part of Mr. Stevenson's proposed lighthouse for the Wolf Rock, of the surf on the upper part, and of the wind on the whole, to be equal to 100 tons. On the bronze column of 90 feet, which Mr. Brown proposed to substitute for the stone structure, the pressure, calculated in the same way, would be only 6½ tons. The natural height of the wave in a storm is supposed not to exceed 18 or 20 feet; but the *surf*, which is, we suppose, half water and half spray, rises, at times, above the head of the Eddystone column, *hooding* the lantern in a watery coat, and sometimes extinguishing the lights. It unfortunately happens, that adding to the height of the column scarcely produces any greater security to the lights; for, as the breadth must be increased with the elevation, the surf, instead of splitting and passing off by the sides, as it would do upon a smaller column, just mounts so much higher, having a greater surface to resist its onward movement. At the Bell Rock, which is not exposed to such heavy seas as the Eddystone, the surf in a storm mounts to the lights, which are 100 feet above the ordinary level of the sea. At such times, the column is felt to *tremble* when struck by the huge mass of rolling waters; and the keepers, perched like two sea-mews on the top of a beacon-staff, with nothing but the raging elements around them on all sides, feel their situation (as they confess) very forlorn, and naturally think of the sins of their past life.

Mr. Brown's proposed metallic lighthouse is 90 feet high, 14 feet in diameter at the bottom, and 4 feet at the thinnest part. The lower half, called the base, is in four pieces, each piece consisting of a portion of a hollow cone (or paraboloid), wider below than above, and about 10 feet high; the lower piece is sunk 3 feet into the rock, and is fourteen feet in diameter at its under margin; the fourth piece is six feet in diameter at top. These four pieces fit into each other, the neck of the lower passing into the socket of the upper, and both being secured by flanges; so that the joints are, in some degree, stronger than the entire part of the shaft. Above these is the smaller part of the shaft, which is in three pieces of nearly the same length, and fitted in the same manner. Above this, the shaft widens out into an inverted cone, which forms one piece, and supports the more important parts. These are, first, the keeper's house, which is 8 feet in diameter, and 7 feet high, with a gallery round it, "for look-out, and walking exercise." Next the lantern 9 feet wide and 10 feet high to the cupola, for containing the lights. The house, or sitting-room, is made of two concentric cylinders of sheet copper, 9 inches asunder, to equalise the temperature, and attached to each other by rivets: it is formed into compartments for bookcases, shelves, and lockers, with a recess for the back of the stove. Immediately below the house, in the swell of the shaft, are the sleeping-berths. To complete the description of the column, we shall add, that the upper section of the base contains two tanks, one for oil, and one for fresh water; the next section, above, is for coals and provisions; and the one above that, a general store. Access is obtained from below by the chain ladder reaching down to the sea; and by ladders in the inside, by which the keepers mount to their aerial abode. The whole

work, 90 feet high, would cost 16,000*l.* or 17,000*l.*, if entirely of bronze; 11,300*l.*, if the base were bronze, and the upper part cast-iron; or 9000*l.*, if entirely of cast-iron; and it would be erected in four months.

The advantages of this plan of Mr. Brown are the following:—1. The expense of erecting lighthouses is much diminished, so that six may be erected for the sum now spent on one. 2. The time necessary for building them is contracted from years to months; and the chances of loss of life in the progress of the work are proportionably diminished. 3. The bronze lighthouse, from the slenderness of its shaft, and the smallness of the resisting surface, will not carry the wave and spray half so high as the stone lighthouse; and, with two-thirds of the elevation, it will afford equal protection to the keepers and the lights. 4. From this slenderness, and its diminished height, the strain of the surge and winds upon it, in a storm, will not exceed one-tenth of what a stone structure is exposed to. 5. It has but eight joints from the bottom to the lantern; while the stone lighthouse has thousands; and the bronze joints admit of being made as strong as the entire part of the shaft. 6. That its separate portions, being complete circles, cast solid, each is, *per se*, capable of resisting any lateral impulse of the water whatever, and the column can only be injured by a transverse pressure operating upon its length. 7. That the cohesion of the materials, or the power of the column to resist fracture by a transverse strain, is probably a hundred times as great as in an equal column of stone. 8. That the natural stability of a bronze column, derived from downward pressure, must be considerably greater than that of stone. In addition to this source of strength, the column is to be secured 10 feet into the rock by numerous bolts; so that it cannot be removed, without carrying all that body of rock along with it, which would require a pressure of several hundred tons.

As to the durability of bronze in water, when proper precautions are adopted, two letters are given from Mr. Brande and Mr. Faraday, which remove every reasonable doubt. Both of them think that cast-iron might answer sufficiently well for the upper part of the column. Nothing is said about the chances of injury from lightning; but the tower, being entirely metallic, it would act, we suppose, as a very perfect conductor, and convey the electricity to the earth without injury to the keepers. Bronze is an alloy of copper and tin. We should have observed that, in Mr. Brown's opinion, a bronze column could be erected on a sand-bank, by piling, or by a different process, which he describes, and where a stone structure would be impracticable.

The situation of the keepers in one of Mr. Brown's lighthouses is one of the most singular which the multifarious occupations of human life present. The stone tower, though really less secure, has an appearance of solidity, which goes some length to satisfy the imagination; but Mr. Brown's watchmen are suspended in mid-air, on the top of the pillar, whose slenderness, compared with its length, reduces it to the appearance of a small rod. Cooped up in a cage, one half of whose narrow floor projects over the sea, or standing on a gallery which hangs over it completely, they live for months together without exchanging words or thoughts with their fellow mortals. There they pass the dark and stormy nights, with the winds howling, and sea birds shrieking around them, while the abyss foams and rages below, and the slender stem that bears them above it quivers under their feet when struck by the angry surge, or beaten by the tempest. No situation can be conceived more dismal and monotonous, more beset with terrifying circumstances, or better calculated to impress the mind with a constant feeling of insecurity. Such, however, is the force of habit in reconciling men to outward circumstances, which appal at first sight, and to real and formidable dangers too, that there is never any want of candidates for the most hazardous employments; and no difficulty is, we believe, apprehended in getting sober considerate persons to commit themselves to these sea-girt aerial cradles; nor any doubt felt, that, after a month's experience they will sleep secure in them, though lullabied by storms and tempests, the aspect of which, in such a situation, would drive a greenhorn landsman mad.

To understand the importance of lighthouses, it may be proper to state, that the number of British vessels shipwrecked annually is about 550, or *one and a half per day*. The average burden per ship of the mercantile navy is about 110 tons; and, if we value old and new together at half the price of building, or 5*l.* 10s. per ton, we have 600*l.* for the value of each, and 330,000*l.* for that of the whole; which may be reduced to 300,000*l.* by deducting the value of sails, masts, and other materials, saved from some of those stranded. If we add an equal sum for the value of the cargoes, the whole loss from shipwrecks will be 600,000*l.* per annum. This statement proceeds on an old estimate from 1793 to 1829; but Mr. Macculloch says, in the *Supplement* to his *Dictionary*, that the number of ships lost, or driven on shore, in 1833, was no less than 800. It is probable, then, that the annual loss by shipwreck is not much short of a million sterling. If one-fifth part of this loss could be prevented by additional lighthouses, the saving in

money would amount to a million in five years, to say nothing of the still more important saving in human life.

NOTES AND NOTICES.

Telegraph.—A new telegraphic system, applicable to nautical purposes, invented by M. Claude Sala, has just been presented as laying claim to the Monthyon prize. It is described as remarkable for its simplicity; for, by the aid of eight signs, it produces, without difficulty, all the words of the vocabulary, and, by means of two lanterns, it can carry on a nightly correspondence.—*Athenæum.*

Arsenic.—M. Schweiger Seidel has invented a very simple method of ascertaining the presence of arsenic in food, &c. however small the quantity may be. He puts a portion of the matter to be tried, and double its weight of soda, into a little glass tube; he closes the open extremity of the tube with blotting paper, and heats the other end with a taper: the arsenic is sublimated in a few moments, and adheres to the sides of the tube in the part which is not heated.—*Ibid.*

Spontaneous Combustion.—An instance of spontaneous combustion is reported in the French papers, to have taken place at Aunay, in the department of Avalon. A very fat woman, aged 74 years, and addicted to drinking brandy at 27 degrees, lived alone, and one evening returned home as usual, but, as she did not appear among her neighbours the next morning, they knocked at her door. No answer being returned to repeated demands, they summoned the mayor, who forced the door, and exposed a horrible spectacle, accompanied by an extraordinary smell. Near the chimney laid a heap of something burnt to cinders, at one end of which was a head, a neck, the upper part of a body, and one arm. At the other end were some of the lower parts, and one leg, still retaining a very clean shoe and stocking. No other traces of fire were to be seen, except a blue flame which played along the surface of a long train of grease, or serous liquor, which had been produced by the combustion of the body. The mayor found it impossible to extinguish this flame, and summoned all the authorities; and, from the state of the apartment and comparison of circumstances, it was concluded among them, that previous to going to bed, for which she had evidently been making preparations, the woman had been trying to ignite some embers with her breath. The fire communicating with the body by means of the breath, combustion probably took place, and would appear to confirm an opinion entertained by several learned men, that that which is called spontaneous combustion of the human frame never takes place without the presence of some ignited body near the person predisposed to combustion. A surgeon who bled an habitually drunken person, accidentally put the blood extracted near a candle, when immediately a blue flame appeared on the surface, which he found extremely difficult to extinguish.

M. Biot.—The learned and scientific M. Biot has been delivering some very remarkable lectures at the College de France. He has proved, that, by means of polarised rays, it is possible to ascertain the chemical action which takes place between bodies held in solution, in various liquids; an action which has not yet been discovered by less delicate means. This is a new branch of science, created as it were by this great natural philosopher, from which the most important and curious results may be expected.

Corn and Cotton-Planting Machine.—A free man of colour, Henry Blair by name, has invented a machine called the corn-planter, which is now exhibiting in the capital of Washington. It is described as a very simple and ingenious machine, which, as moved by a horse, opens the furrow, drops (at proper intervals, and in an exact and suitable quantity,) the corn, covers it, and levels the earth, so as, in fact, to plant the corn as rapidly as a horse can draw a plough over the ground. The inventor thinks it will save the labour of eight men. He is about to make some alterations in it to adapt it to the planting of cotton.—*New York Paper.*

Dr. Arnott's New Stoves.—At a meeting of the Philosophical Society of Edinburgh, which took place lately, one of Dr. Arnott's new stoves was exhibited. It is an oblong box, about three feet long, two broad, and two deep, carefully made air-tight on every side. A partition within divides it into two parts, apertures above and below enabling them to communicate with each other. An aperture is arranged for the free admission of air, and another for carrying off the smoke; an air-tight door admits fuel. A stove made of earthenware, and placed on one side of the partition, contains all the fuel required, and the hot air circulates round and round the partition before it is eventually carried off by the small tubular chimney. An extensive surface of 32 square feet is thus presented to the air at a moderate elevation of temperature, about 212; and accordingly, scarcely any thing passes up the chimney which has not been almost entirely exhausted of its heat. This stove saves equally time, trouble, and fuel, and is quite free from the dust of a common fire.

Dr. Reid's System of Ventilation.—At the conclusion of the same meeting, the Society adjourned to a new apartment, constructed by Dr. Reid, illustrative of his arrangements for ventilation, &c. It is 32 feet long, and 18 broad, the floor being pierced with 50,000 apertures for the admission of air. A series of experiments have since been commenced in it, in one of which, intended to show the working of the flues, 100 individuals remained in it for upwards of an hour, the room having been alternately filled with warm and cold air, and partially charged with ether and nitrous oxide, at different times. The air was completely renewed by a slow and insensible current every five minutes, and the various changes so gradually induced, that it was impossible to tell when they commenced. The plan is equally applicable to public buildings and private dwelling-houses, as well as to hospitals, churches, public assemblies, and all those places where, from a crowded apartment, the air becomes oppressive both from heat and noxious effluvia.—*Scotsman.*

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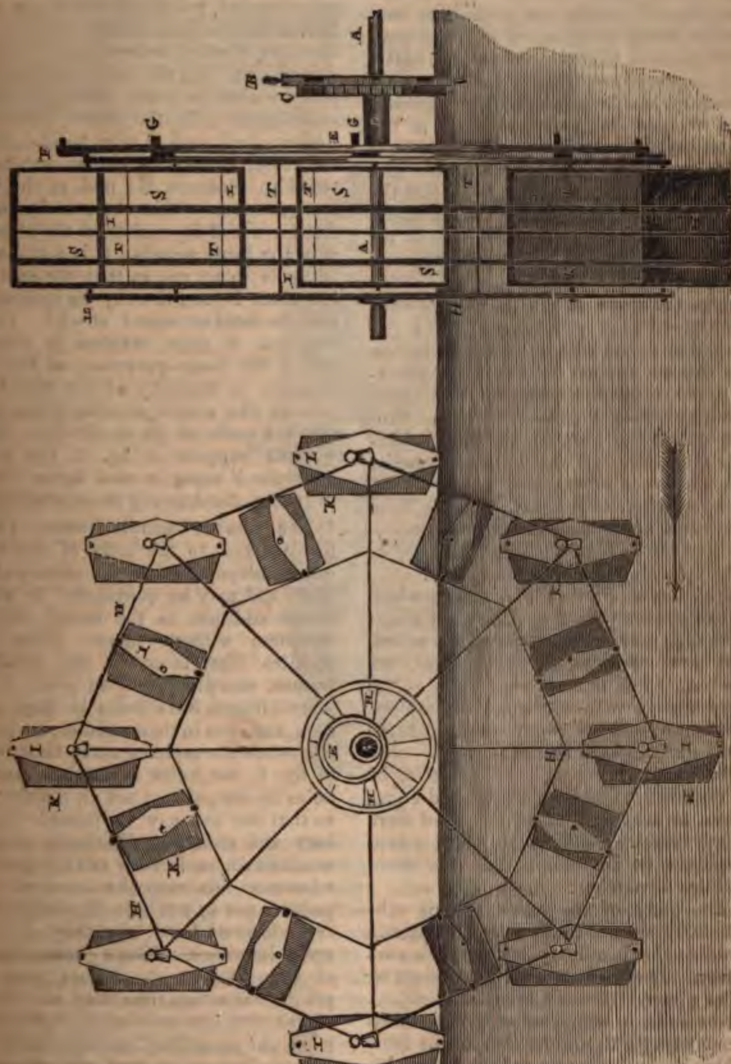

Fig. 2.

Fig. 1.

PICKWORTH'S PADDLE-WHEEL.

PICKWORTH'S PADDLE-WHEEL.

The prefixed engravings represent a new paddle which has been invented by Mr. Henry Pickworth, of Sipson, in the county of Middlesex, and for which Letters Patent have been granted. The advantages claimed for the wheel are,—that it does away entirely with concussion, and therewith the tremulous motion so much complained of in steam-vessels—that it produces no tail-water, and causes, consequently, no drag on the vessel, or on the power of the engine—that it may be placed so deep in the water that the propelling-paddles on both sides shall constantly be below the surface, even in the worst weather—that the paddles may be generally so arranged that every paddle upon ceasing to be for the time a propeller, shall present itself obliquely to the floating medium, even though the wheel should be wholly submerged—that it is not liable to be damaged or obstructed in its action by the sea striking against it, and needs, therefore, no protecting-case or paddle-box (saving thereby a great deal of very inconvenient top weight), the only substitute requisite, and that but occasionally, being a screen of canvass, or some other light material, to prevent the spray from the wheel being blown upon the deck—in fine, that it is equally effective, or nearly so, under all circumstances.

Fig. 1 is a side view of a paddle wheel of this construction; in which, for clearness sake, one half the body of the wheel, and also some of its appendages, are omitted. Fig. 2 is an end view of the same wheel, with all the parts complete. The same letters of reference indicate the same parts in both figures.

In fig. 1 the wheel is supposed to be at rest, with all the paddles placed edgeways, or nearly so, to the stem and stern of the vessel. In fig. 2 the wheel is supposed to be in motion, and the lower paddles advancing.

The body of the wheel HH is substantially similar to that of the common paddle-wheel, only that it is much narrower. The radial arms have circular holes pierced through them at their extreme ends, in which holes revolve transverse bars (with cranks GG at one end) which carry the larger paddle-frames II. *These frames support parallelogramic paddles KK, each of which turns on an axis, which axis runs from end to end of* the paddle parallel to its side edges; not, however, in the centre of the side, but at a short distance therefrom, projecting a little beyond each end. This axis is also so put into the frame as to turn *toward* the vessel's side as it closes upon the frame, by which means a sea striking the wheel even on its broadside would, it is apprehended, produce little, if any effect. D is a hollow shaft, moveable in a collar, the bore of which hollow shaft is of such dimensions, that the main shaft A shall just be able to work within it without touching it. To the outer end of this hollow shaft, and as near to the side of the vessel as may be convenient, is fastened an eccentric E; and to the inner end (which is *within* the vessel) there is fixed a wheel B, similar to the steering-wheel in large vessels. C is a cog-wheel for palls to act on, so that the said hollow shaft D, and thereby the eccentric E, may be fixed or moved at will. On the eccentric E there revolves a wheel F called the frame-governor, of the same diameter as the body of the wheel, and pierced like it with circular holes, which take the necks of the cranks GG, shown without support in fig. 1, the frame-governor F being in that figure omitted to render the drawing more intelligible.

The smaller paddle-frames II are firmly fixed to the body of the wheel, quite independent of the eccentric motion, and may be considered as an optional addition to the wheel, which is complete without them. They carry paddles like those in the revolving-frames, excepting only in point of size. These frames have holes in their radial bars, and also in their paddles, so pierced that when the paddles are in the position of fig. 1, the holes in the bars and the holes in the paddles are in a direct line, so that one rod may be passed through bars and paddles collectively, and thus maintain them in their relative positions whenever this may be required. The paddles are so put into the frames, both revolving and fixed, that they shall turn upon their axes, taking a general bearing or support from the frames when propelling, at which time they are at right angles with the side of the vessel—and when *not* propelling, having other bearings or points of rest also within the frames, which retain them at right angles with the frames, or nearly so.

The lines SS, fig. 2, represent the axes

Fig. 3.

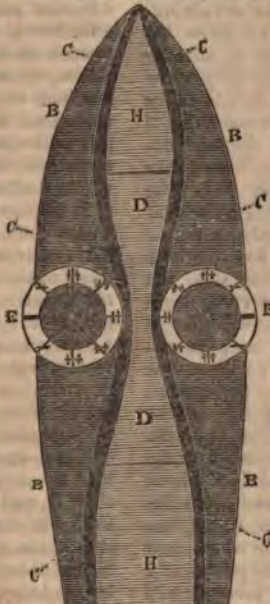

Fig. 4.

of the paddles in the frames when revolving as well as when fixed; both have the appearance of being continuous, but they are not so in reality, that appearance being produced by the axes being in two planes, each of which is viewed edgeways.

The lines TT, fig. 2, seen through and between the revolving-frames II, are the transverse bars of the fixed frames.

The open paddle-frames, fig. 2, have their paddles coincident with their axes SS, and are thus partly hidden by them and partly confounded with them; it not being possible to display the foreshortening of the paddles on so small a scale as that to which we are restricted by the size of our pages.

In fig. 1 the wheel, as has been observed, is at rest; but a wheel of this construction never could, in point of fact, be as represented, unless the paddles of the fixed frames were secured in the manner previously described—for the broader sides of the paddles in the fixed frames yielding to the force of gravity, would close those on the right hand, which, however, would be opened the moment that the wheel was set in motion for for-

ward movement, that is to say, in the direction of the arrow; the centrifugal force, the pressure against the air, and the pressure against the water, all combining to produce the above effect. To obtain this effect, however, the centrifugal force of a moderate velocity would be more than sufficient. The paddles have been placed in this imaginary arrangement here represented, in order that their relative positions with the frames might be seen.

Suppose fig. 1 to be set in motion in the direction of the arrow. By inspection it will be seen, that the revolving-frames *below* the main shaft have the broader sides of their paddles *in advance* of the circular motion of the body of the wheel, and the revolving-frames *above* the main shaft have the broader sides of their paddles in *the rear* of the said motion; while the fixed frames, both above and below the main shaft, have the broader sides of their paddles in the *rear* of the said motion. The paddles in the frames, both revolving and fixed, are so arranged, that in opening they shall not be able to attain to a perfect right angle with the frames, in order that when *active* pressure exists, their *sides* may be exposed thereto unequally. It will now be evident, that the active water pressure on the broader and advancing side of the paddles in the revolving-frame while *descending* having a preponderance over the pressure on the narrower and rear side of it, must turn the paddle and close the frame. When, again, the frame has passed the lowest point of the wheel, and *ascended* so far as to have no power as a propeller, the active water pressure will be in the rear of the paddle, which thus pressed behind will instantly yield and open the frame, so as to let the water pass through, instead of arresting it and causing it to act as a drag on the speed. The fixed frames must, of course, from the arrangement of their paddles, remain open.

Suppose, further, that the motion of the wheel were continued, and that by a heavy sea, or from any other cause, the entire wheel were submerged, the paddles below the main shaft would continue effective as before, while all the paddles, both revolving and fixed, that *are above the main shaft*, having their *broader sides in the* rear of the said motion, *would neither give* nor receive resistance; the wheel, therefore, would continue as effective a propeller as before, as will be clearly perceived by reference to fig. 2.

When a vessel has head-way upon her, and it is desired to "*stop her*," let the motion of the main shaft be arrested, as in the case of the common paddle-wheel; the way of the vessel through the water will suffice to cause a pressure in the direction of the arrow, the revolving-frames which are closed will open, and the fixed frames which are open will close and form a drag upon the vessel like the common paddle-wheel, but much more effective in proportion as the opposing paddles are deeper in the fluid; and this action, it will be seen, is entirely independent of the eccentric, or any thing connected therewith. If the motion of the main shaft be reversed, then back action will be produced also, after the manner of the common paddle-wheel.

From the peculiar construction of Mr. Pickworth's wheel, the whole support of the revolving-frames, as well as of the fixed ones, is thrown upon *the body of the wheel*. What is called the frame-governor F has merely to retain the revolving-frames in their assigned position, whatever that may be. The consequence is, that there is no friction upon the eccentric E beyond what the mere weight of the wheel F would produce, so that one man stationed at the wheel B is enabled by means of it to turn the hollow shaft D, and with it the eccentric E, round the main shaft, and thus change the position of the point of support of the wheel F, and thereby the position of the revolving paddle-frames.

If there should ever be occasion to substitute sails for steam-power, an iron rod being run through the holes in the radial bars of the fixed frames, and through the paddles corresponding thereto, as before described, the wheel would present the exact appearance of fig. 1; and the paddles in the fixed frames being thus made immoveable, as regards their frames, would act as lee-boards.

In crowded rivers, and under other circumstances where great care is necessary, it is intended that a man shall be stationed at the steering-wheel B, who with his foot may command the palls acting on C, and, by turning the wheel B, augment or diminish the power of the paddles on his side of the vessel, without

interfering with the action of the main shaft. When the paddles are in full action, one-half turn of the steering-wheel B renders them entirely passive; and if this be effected on one wheel while that on the other side remains in full force, the vessel is brought short round upon her heel, independent of the rudder, which may, however, be used at the same time.

From the water-line in the drawing, it will be seen that it is intended to place this wheel so deep in the water that no alteration in the loading or the trim of a vessel can sensibly affect its propelling power; in fact, unless a vessel be thrown nearly on her beam-ends, such a wheel as this can never be entirely out of water. Should the revolving-paddles ever become from any cause unmanageable, the fixed paddle-frames may be closed, and the paddles secured in that position by passing the rod, before spoken of, through the fixed frame radial bars merely; the wheel may be thus converted in a few minutes into the common paddle-wheel.

The fixed frames are so secured to the body of the wheel, that they may with their paddles be entirely removed in a few minutes without interfering with any other part of the machine; they may be replaced also in an equally short space of time. And when the fixed frames are so removed, the wheel will remain as effective as before.

Nearly the same effects may be produced in a different manner. Suppose the forward movement of the vessel to be effected as previously described, and that the command is given to "stop her." The stopping of the main shaft would merely arrest the propulsive power of the wheel, which in many cases is all that is desired; but should it be wished to add a drag upon the vessel's way, this may be regulated to any extent—from a mere line to the entire superficies of the whole of the immersed paddles—by a half-turn of the steering-wheel B, or so much less than a half-turn, as may be deemed sufficient. A reverse motion of the main shaft then gives the back action.

In order to protect the wheel from gun-shots, it is intended that wheels on the principle of this patent shall be wholly submerged when applied to vessels of war. The arrangement shown in figs. 1 and 2, without the fixed frames and their paddles, would be suitable for such a purpose; but it will probably be found, in most cases, necessary to reduce the diameter of wheels so used, and to increase the number of their revolutions proportionately.

Following out this idea, let us suppose that the fixed frames with their paddles are removed, and that the highest paddle remaining is completely under water—the wheel propelling in the direction of the arrow. Now, a half-turn of the steering-wheel B would, without reversing or in any way interfering with the motion of the main shaft, instantly give back action equal to the fore action on the other side of the vessel; so that this movement of the steering-wheel B being performed on one of the two wheels only, the effect would be to bring the vessel round upon a point within her keel, and to make her turn gradually round upon that point as long as the wheels in that position could be impelled. A man-of-war would thus have the advantage of being able to bring her broadsides to bear in succession upon any given point by a regular movement, without any effort beyond the first adjustment of the wheels—the whole not the work of one minute.

The wheels in the case last supposed are assumed to be not only submerged, but in a *vertical* position like that of the common paddle-wheel. Mr. Pickworth, however, considers that his wheel would be quite as effectual a propeller, if attached to a vessel in a horizontal position, as in any other. All that is thought to be necessary is a modification in the arrangements of the vessel. A great breadth of beam, with a light draught of water, are the obvious requisites for a vessel with horizontal wheels; and these, it is presumed, might be combined with advantage for passenger-vessels and for war purposes. A vessel of the form somewhat like that displayed in the engravings, figs. 3 and 4, might perhaps be found suitable.

Fig. 3 is a side view, and fig. 4 bottom view. A, the gun or passenger deck; B, main-floor of the boat; C, the keel-floor; D, engine-room; E, wheels; F, rudder; G, the position which the wheel E would occupy if placed vertically in the usual manner; H H, coal-holes; and I, line of floatation. Any modification of this arrangement which may suggest itself to the scientific builder might be very readily introduced. For

example, the wheel itself may be made buoyant by a drum on the main shaft, if such an adjustment should be thought desirable.

We are inclined, on an impartial consideration of the whole subject, to think that Mr. Pickworth has rather attempted *too much* by striving to combine all the advantages of the best form of moveable float-boards with all the advantages of the common paddle-wheel; while, at the same time, to avoid the disadvantages of both one and the other, he has given a degree of weight to his wheel which may weigh considerably against it. It is, however, but justice to remark, that by a judicious arrangement of his materials he gets the needful strength with perhaps as little weight as possible. He will, we hope, excuse us for suggesting, that his paddle-frame vertical bars might instead of plates of metal have rods (following the outline of the plates) substituted for them with advantage. In the case of a sea striking the wheel on its broadside, the rods would offer less resistance than the plates.

We beg these remarks to be understood as applying to figs. 1 and 2 only, for upon the horizontal wheel we do not venture to give an opinion; all that we can say is, the arrangement seems to us to be ingenious and worthy of consideration.

We are informed that it is the intention of Mr. Pickworth to charge no patentee's premium upon his wheels, but to give permission to all respectable engineers to manufacture them, on condition of his being paid a small annual charge upon every vessel to which they may be applied, so long as she may continue to use them. This, at all events, is a proof that no advantage is desired by the ingenious inventor other than what the real and positive superiority of his wheel may procure for him.

BRIGHTON RAILWAY BILL.

The Evidence against Tunnels.

Sir Anthony Carlisle, M.D., examined by Mr. Hill.

I am vice-president of the College of Surgeons, and have been a public practitioner about forty-four years in London. As a part *of my professional duty,* but more especially *in my scientific pursuits,* I have attended to *the subject of tunnels on railways.* It must necessarily happen that at very few seasons of the year there can be the same temperature in the external atmosphere and the stationary air in the body of the tunnel; there must necessarily be some marked difference, for in the winter season the air in the tunnel will be considerably warmer, and in the summer season the air in the tunnel will necessarily be colder than the external air. Such a variation of temperature will expose persons in health to the common affection notoriously termed catching cold, the source of other disorders; they may be inflammatory or they may be of other kinds; but the common phrase of catching cold, I believe, arises from its being found by experience that people are apt to take a disorder called a cold or catarrh by sudden transitions from heat to cold or from cold to heat. I entertain no doubt that the variations in temperature to which I have referred will be sufficient to put persons even in health in danger of cold by passing through a tunnel. I think it must of necessity be so; for although a person may pass sometimes with impunity, he cannot be always assured of passing through a tunnel under the stated circumstances with impunity. Most striking effects would be produced on persons of weak constitutions or who are invalids. If your lordships and the Committee will permit me, I will generally state, without being too prolix, the reasons for my entertaining this opinion. The surface of the body and the inner surface of the lungs are the two portions of the living frame most exposed to the vicissitudes of temperature in the air. Persons with weak lungs being subjected to the alternation of heat and cold or cold and heat, by such transitions must necessarily have disordered conditions of the lungs aggravated; so in the influences upon the external surface of the body, catching cold is commonly and justly imputed to the external application of change of temperature; hence persons are said to "catch their death of cold in damp sheets," and on exposure to a current of air, because the current of air, though of the same temperature, does not accord with the temperature or halo immediately surrounding the living body, which in a healthy man is at 100 degrees, such halo surrounding his body approaching nearer to the temperature of his body than to the external atmosphere; and hence, if a stream of air blows upon him, it produces a sensation of cold, and in fact it has the effect of a different temperature from that which envelopes or surrounds the person. Besides catching cold in passing through a tunnel, a person is subjected to all the modifications of disorder of the lungs which have a tendency to inflammatory nature, active or chronic; and also erysipelas, a very dangerous disease, is known very frequently to hap-

pen from sudden transitions from heat to cold. Rheumatism, in its various forms, lumbago, both acute and chronic; that is, active or long continued. I would not permit one of my patients to go to Brighton by a railway that had a tunnel in it; I should endeavour to dissuade any patient of mine from subjecting himself to such perils. I should prefer that the patient should go by an open carriage on the open road in preference to going through a tunnel, for the reasons I have assigned; I would not hesitate about it. I have no experience about the length of tunnels; I know something from experience of the difficulty of changing masses of atmosphere either in tunnels or in a large room; it is impossible to change the atmosphere in a large room, and I apprehend it would be impossible to change the atmosphere of a tunnel 600 yards long. The observations I have made apply to a tunnel of five or six hundred yards. I have understood the tunnel in question is to that extent. I think a patient might safely go by an open railway; rapidity of motion to a delicate person would be an objection, since there would be an extraordinary change in the blanket of air belonging to the person in going along. The air in the interior of the tunnel is not precisely the same as that without; it is stationary air, having a different temperature; and it has also a commixture with other gaseous substances; it is also a damp air; if it was a warmer air than the ambient atmosphere, I think in that case speed would make it less dangerous. The majority of cases in which persons catch cold have been from going out of heat into cold; there is, however, danger on being exposed from cold to heat; many persons catching cold from sitting over a fire, or from going into warm rooms; I do not speak conjecturally.

Cross-examined by Mr. Serjeant Merewether.

I have no experience beyond the rationale I have endeavoured to give upon the subject, which is, that the change of atmosphere surrounding the individual produces the effect of chill or cold to the surface of the body; but that can be remedied by warm clothing or a close carriage. I have not arrived at the conclusion, that a slower conveyance is better, inasmuch as it may be an object that a weak person should be suddenly transferred from London to Brighton. I have stated that the atmosphere in the tunnels I assume to be nearly stationary. I do not know what length of tunnel would ventilate itself practically; but I know something about the matter with regard to wells and borings of other kinds, and I have had some experience upon the subject; a well would be in different circumstances from a tunnel, which would be open at both ends, whereas in a well there would be only an opening at the top operating upon the well. I know from experiments that a tube filled with air of considerable dimensions does not easily discharge its air by any external force employed upon the confined air, but the contrary, because of the elasticity of the air,—its propensity, if I may use such an expression respecting a passive thing,—is to avoid pressure, and to get behind any compressing force,—as in the case of pressure from a piston or any thing of that kind; I know from experiments it is difficult to discharge a tunnel or a large room of any stagnant or quiescent mass of air; and I believe a 600 yards tunnel of the dimensions given would neither discharge itself nor could it be discharged by any ordinary known means. If there should be a difference in the atmosphere in the tunnel, and at the two ends of it, there would be a natural tendency in the air to equalise the difference; that is to say, if the air is colder on the inside it would have a tendency at the ends of the tunnel to mix with the atmospheric air; and, *vice versa*, if the air in the tunnel was warmer than the air outside, it would have a tendency to equalise itself with the external air; but this only to a limited extent; the two atmospheres, the atmosphere within and the atmosphere without, being on a different balance, would soon strike the balance in the length of a tunnel of 600 yards, and I think long before they arrived at midway; so that you could not expect from any change of temperature a current of air to pass through the whole of the tunnel. Shafts let down in the middle of the tunnel, or in other places, would have but a very limited tendency to create a draught in the tunnel; for in the attempts to ventilate, with submission, the late House of Peers and the House of Commons, the most scientific persons were consulted, and every means were devised; but I believe the means were not effectual to discharge the air confined in those rooms, although not very large, and to have pure and refreshing air introduced in its stead. I am not practically acquainted with the effect produced in cases where such shafts have been introduced into tunnels. I know that in rooms a shaft in the roof has not had any good effect. I have seen two tunnels near London, the one near the Harrow-road, and the other near Islington. I have attended to that as to my own feeling. I have walked part of the way through them, and have ascertained that the feeling corresponds with my theoretical view, and what I have read on the subject, and what I have said corresponds with my own feelings. The tunnel I refer to near Islington Hill is completed; it is for a barge-way; but there is another also near the burying-ground at Kensal Green. I

walked through part of the way; it is not finished; the centres and other impediments all in the way, but machines driven by steam were going into the tunnel; the tunnel was carried quite out to the other extremity, I believe; there was a light visible at the other end. I do not think that a shaft in the middle of a 600 yards tunnel, or two or three shafts, would have any great and efficient effect in discharging the quiescent air, or of moving it out at either end, or even upwards; that is my opinion. Supposing there were shafts, and there were carriages propelled by steam passing frequently through the tunnels, my opinion, founded on analogy, and not from any personal observation, is, that the ventilation would not be efficient. I do not think that would be an effectual check to the stationary temperature, or that a stationary air would be removed. I have gone with scientific persons to visit mines. I was brought up in the county of Durham, and knew the coal-pits then. I had the charge of two or three coal-pits when I was young. The workmen insured medical attendance by paying so much a week; we had a good many patients. They were not more than twelve hours out of twenty-four in the pit; but it is so long since, I cannot charge my memory with the number of hours, but they had a great deal of holiday above ground. They are healthy men generally; but asthmatic men, I believe, could not work; and there was a singular thing happened in regard to horses which were worked in the collieries—it was the prevailing opinion, that a horse brought up in the collieries when he came above ground went blind. I cannot say that he was generally very fat when he came up, but he went blind, and the pit-horse was not a saleable horse. If the engine goes at the rate of fifteen miles an hour, the half mile would, of course, engage two minutes, and the time calculated for thirty miles per hour would be one minute for the transit through the tunnel, so that there would be three changes operating upon the individual, provided the air were different on the transit from the atmosphere to the tunnel, and on the transit from the tunnel to the atmosphere again, thus making three dips. If a hale person, undergoing the exercise of travelling upon a railroad, comes to a tunnel which he will be a minute, we will suppose, passing through in a carriage, still undergoing the motion of the carriage, I do think he will be likely to catch either cold or catarrh; and my opinion is founded on long experience; the transition would endanger a person even during the duration of one minute. *I have known* a person to become erysipelatic from a minute's exposure to the air, and the change occasioned by it; a man of some celebrity lost his life from that very circumstance within the last month, Mr. Barry O'Meary. He was sitting near a window, he felt himself cold from the air of the window, and he changed his place, and from that exposure he went home and took to his bed and died. I say it is the same thing in effect, whether the carriage draws the individual at the rate of thirty miles in the hour, or the wind travels at the rate of thirty miles an hour, since they equally affect the person; it would be the same as to the person, whether on the surface of the lungs or on the surface of the skin, with this difference, that in the open air the air would be uncontaminated, while within the tunnel the air would be mingled with deleterious matters. Under the circumstances propounded, a person is likely certainly either to catch cold on the surface of the skin, but preferably the catarrh of the lungs; I say that in a transit of only one minute he is in peril, and I would not so expose myself. A hundred persons may pass through with impunity, and the next five may all be seized with some dangerous illness, and for that reason I would not recommend a man to go through a tunnel. I do not mean to say it is 100 to 5, I only speak hypothetically. Certainly many may pass through without any difficulty. Supposing they went through in a carriage, pulling up the window for a time would operate as a considerable preventative; but that would also come to a moral question, whether the passengers choose to have the window up generally; for in stage-coaches half the passengers wish the window up, and half wish to have it down. The ratio of any bad consequences would be much in proportion to the length of the tunnel. The pulling up the windows would be a certain degree of protection, but I cannot say how much.

Re-examined by Mr. Hill.

I have heard that on railways persons travel in two classes of carriages, one open and the other close; but I have not seen it. Persons may go into crowded hospitals where they are in great risk of contagion, and yet not take disease; they may visit a house or a place having a patient affected with the plague, or they go and visit a person with the cholera, and not take the contagion, and that produces a paradox in the medical world on which there is a division of opinion. A person escaping would not be a sufficient ground for placing himself in those circumstances. The air of a tunnel is impregnated with other gases, which makes it very different from the outward air. Sulphuretted, carburetted, and carbonic gases would be emitted from the burning of the coke, and the vapour of the steam would be condensing and would keep the atmosphere damp; and you would have also the effluvia and respi-

rating products of the passengers going through, assuming hypothetically that the atmosphere is little, if at all, changed, the mass of it in the middle of the tunnel; so that a quantity of stationary or stagnant air would remain impregnated with poisonous gases, or impregnated with the effluvia of the passengers; it might be with scarlet fever or the small-pox. It is my decided opinion, from all the facts and all the consideration I have given to the subject, that the air in the interior of tunnels is in nearly a stagnant state. I think it is reasonable to conclude, as it is philosophically evident, that there must be a progressive accumulation of unwholesome or unsafe atmosphere within the tunnel, unless it can be wholly drawn or driven out in a mass, and I am not aware of any method by which to discharge it; hence there must be a progressive accumulation of evil. I know that a minute is quite sufficient to produce catarrh. It is just the rapid transition from the outward air into the tunnel, and then again into the outward air, which creates the danger. It is like exposure to the wind, and every body knows when wind is cold; in winter, although under a hedge where cattle would seek shelter, you do not feel it, notwithstanding the wind is blowing from the north. The three sudden transitions are not favourable to health; getting into an atmosphere of sixty, and making an exit from the tunnel again at thirty, must expose a person to three vicissitudes within half a minute or a minute, as it may happen. With respect to the comparison between persons going through a tunnel to persons going into a mine, very great care is taken, and very great expense incurred for the purpose of ventilating mines; those who go into mines for the purpose of labour do not expose themselves to those very sudden variations. They are tolerably well clothed, and they all take care of the inward man; they are all drinkers; but whether that does good or harm I will not say. Even considering the horses do get fat down in the mines, I would not think of sending invalids and timid and delicate persons down into mines. There have been various projects, and there is nothing, however absurd, that has not been tried in medicine; but I believe it was never yet tried to send a person into a coal-pit to cure him of any disease of the lungs. Dr. Beddoes tried experiments by artificial airs, and putting people into cow-houses, and the Lord knows what; but I do not believe that his schemes have been followed by any of his brethren. I should not send my patients to a watering-place, if the way to it were to lie through a coal-pit. Persons retain their health in coal-pits, so do some also who work up to their middle in water; but that would be a very bad reason for recommending that to a person affected with disease of the lungs. In bleaching-grounds I have seen men at four in the morning with the dew on the grass, which is very cold, working with bare feet; I believe they are a healthy class of persons; but when I went fishing on the same grounds, I took care to have good elastic water-proof boots. Railways, inasmuch as they furnish the means of rapid and easy transit, I consider to be very favourable to invalids. They would not be exposed to dust or rain, I apprehend, and the transit would be rapid: and by proper clothing and proper attention to the windows of the carriage, they may avoid any danger. I would not hesitate to send a person with diseased lungs by railway to Brighton; but I would not send him through a tunnel. It would be a great public benefit to have railroad conveyances for invalids without a tunnel.

Mr. Serjeant Merewether. — There have been means used for ventilating the House of Commons; cannot the same means be used for ventilating tunnels?—I believe the same means cannot be applied; I should think not.

Examined by the Committee.

The same danger would occur to a person passing through those different temperatures of air, at the rate of thirty miles an hour, that would occur to him if the air through which he passed travelled the same rate; the cases would be analogous. A protection might be afforded by clothing. Water-proof clothing would protect a person against the vicissitudes; how far that would operate in an open carriage on a railway, I cannot say. In a warm room there would be a quiescent temperature; but in the alternate atmosphere affecting a man's body when passing through a tunnel he would pass through a general change of atmosphere, which would wash off, if I may use the expression, the local atmosphere around him. Going at the rate of thirty miles an hour would increase the circulation very little. That sort of agitation in a carriage is not considered productive of a great deal of accelerated influence on the circulation of fluids, to use a pedantic expression. Supposing that to take place, it might or it might not prevent the danger of that accelerated transition; if it increased the natural heat of the body, it would expose the body to the vicissitude of cold much more than if it remained in a temperate medium. If, instead of going in a carriage drawn by steam through a tunnel, the individual were to run through it, there would be the additional consequence of the increased circulation of blood, for running accelerates the circulation of blood very remarkably, but not the motion by travelling in a carriage at thirty miles an hour. The chief difficulty found in ventilating the Houses

of Parliament, was not so much in changing the body of air, but in doing it without introducing some kind of draft so as to inconvenience the Members of Parliament, many of them sitting without their hats, and therefore very likely to take cold, and that it could not be got over; it was a difficulty the medical profession always felt.

Dr. James Johnson, examined by Mr. Waddington.

Are you one of the physicians to his Majesty?—Yes.

How long have you been in practice?—About eighteen years.

Have you turned your attention to the effect likely to be produced by passing through tunnels at the speed of thirty miles an hour?—I have thought upon the subject; and I have been often through the tunnel and along the Liverpool and Manchester Railroad.

I believe that the engines do not go through that tunnel with very great speed?—No; the tunnel next to Liverpool they are drawn through.

In your opinion, as a physician, would you advise any person of delicate health to travel through a tunnel under those circumstances?—No, I should not, if the tunnel was of any length.

Do you think that a tunnel of 600 yards in length would produce any injurious consequences?—A tunnel of 600 yards, if it is eighty feet under the surface, must of course have a temperature constantly of about fifty-two or fifty-three degrees; consequently in summer, when the temperature of the atmosphere would be summer-heat, or seventy-six degrees, the vicissitude would be upwards of twenty degrees on immerging into the tunnel. On the contrary, if the temperature was at the freezing-point, thirty-two degrees, the rise of temperature on going into the tunnel would be twenty degrees, and the exit would be on one of equal extent and magnitude.

In your opinion the temperature of the tunnel would be pretty nearly stationary?—It would be always so, if it was eighty feet below the surface of the earth.

What, in your opinion, would be the source of the greatest inconvenience or danger in passing through these tunnels; would it be the change from the atmospheric temperature to the temperature of the tunnel?—Both changes must take place.

Would that, in your opinion, be productive of serious evils?—I think the vicissitude of twenty degrees or fifteen degrees would very often be injurious, because we seldom have a vicissitude in this climate equal to *that in a whole day*; and we know that the *vicissitudes of temperature* and drought and *moisture are the chief* causes of pulmonary *complaints* and many other, such as rheumatisms, in this climate; consequently, in winter and in summer, I consider that the transitions would be to that amount that would endanger health. When the temperature of the atmosphere was about the same temperature as the tunnel there would be very little danger or inconvenience.

To what complaints do you think that those changes would be peculiarly injurious?—Pulmonary complaints, rheumatisms, &c. People who are susceptible to atmospheric impressions would be more injured than those who are much in the open air.

You are speaking generally of delicate persons, because of course persons of very strong health may stand it. Is erysipelas sometimes produced by sudden changes of air?—Yes, it is. I attended Barry O'Meara, who died of that complaint, as Sir Anthony Carlisle has mentioned, and he got it by standing at an open window.

Do you think that the sudden change from light to darkness would be productive of any injury to persons in a nervous state?—I think reverberation of sound is of more consequence than the vicissitude of temperature.

That you speak to from your own experience?—Yes; because in going even under the arches on the Liverpool and Manchester Railroad it is like a peal of thunder, and consequently in a long and confined space I conceive that the reverberation would be tremendous with a locomotive-engine; if it was drawn slowly it would not have that effect. I think that the noise in going thirty miles an hour would give a very great shock to delicate people.

To persons liable to affections in the heart or head, would it be dangerous?—Yes.

Would you send such persons through those tunnels?—No, I would not. If you will give me leave I will read a few lines which were printed two years ago upon this subject, and consequently they could not be directed to this inquiry.

Had you turned your attention to this subject two years ago?—I wrote a tour, and included the railroad in that tour, and this was the expression that I made use of: "The deafening peal of thunder, the sudden immersion in gloom, and the clash of reverberated sounds in a confined space, combined to produce a momentary shudder or idea of destruction, a thrill of annihilation," &c.

Those were your sensations, were they?—Yes.

And that, I understand, was an engine that did not go at the rate of thirty miles an hour?—That was in going under the arches; in the tunnel they go at the usual rate, from twenty to thirty miles an hour.

Of course those arches were very small in length; perhaps as much as thirty or forty or fifty yards?—Not so much.

Have you the least doubt that in going through a tunnel of 600 yards at this speed the effect upon the senses would be very great indeed?—I think the shock from the reverberation of sound would be very disagreeable, to say the least of it, to sensitive people.

What would you think of sending a delicate lady by a railroad of this sort?—I should not advise it.

Would you ever think of such a thing?—No; not if there were other conveyances.

Would any thing induce you to send a lady in a state of pregnancy by a locomotive-engine through one of these tunnels?—I would never think of recommending it at all; on the contrary, I should advise her not to go by it.

Would you advise a delicate person to go by a railroad where there were no tunnels; would you have the same objection to that? —No; the only objection is passing the arches, and that is momentary.

Would there be objection from the speed in going in the open air?—No, not at all; I consider it pleasant at various times. I have travelled upon the Liverpool and Manchester Railroad, and I liked that mode of travelling better, both inside and out, than by the common carriage.

Then all your objection applies to passing through those tunnels?—Yes.

On the contrary, it would be a great advantage in sending down invalids that they should perform the journey with great rapidity?—Of course.

We have had it from a witness before; but do not you know that a vast number of invalids are sent from London to Brighton for their health?—Yes; a great many are sent, and a great number go voluntarily, for their health.

You have stated to us your objections, from the state of the temperature and from the sound, have you any other with respect to the gases which would be evolved from this engine; you are aware that the engine is to burn coke?—Yes, I am. I think that there would be very considerable inconvenience from the heat of the engine, independently of any gas or any deleterious atmosphere. I think that there will be experienced in these tunnels a very considerable inconvenience, from the heat being rolled rapidly over their heads, particularly to those who are in the open carriages, and where it cannot be expended in the atmosphere as in open railroads.

And from the vapour which is produced by the coke?—Yes.

What is the gas produced by this coke?—Principally carbonic acid gas; but I do not think that of so much consequence as the temperature.

Cross-examined by Mr. Wood.

Are you aware of the time in which a tunnel of 600 yards will be traversed?—I calculate about a minute.

And, assuming it to be about a minute, you think that those consequences will arise? —I do not think the shortness is of any great consequence, because the sudden vicissitude of twenty or thirty degrees, for instance, in a minute will produce very considerable effects.

You do not think it possible that a tunnel of 600 yards could be so ventilated as to bring it to an approximation to the temperature of the general atmosphere?—I think it impossible to alter the temperature, because it must take the temperature of the parts surrounding it; the air might be changed, but whenever changed it would instantly come to the temperature of the solid parts around.

The change would be something like that of a gentleman going into a cellar for a bottle of wine?—Yes. I consider there would be something like ventilation by the rapid movement of the carriages, because the train must dislodge from one end or other a volume of air equal to the train itself; and therefore when the train went on there would be that volume dislodged; there would also be a slight current produced by the rapid transit of the train.

For inside passengers there is no means of obviating that matter by putting up the windows?—They might put up the windows.

By submitting to a circumambient blanket round them in that tunnel they would escape the danger of catching cold?—They would escape it much more than by not doing so; but it is impossible to obviate it wholly, because it is impossible to make the carriage wholly air-tight; and if the windows are put up they will be obliged to put them down directly they get out of the tunnel again.

And when they get out of the tunnel they will be in the same temperature as they were before they entered it?—Yes.

And they may have Macintoshes, and so on, to protect them?—They cannot cover their lungs; they may, of course, protect the surface of the body, but not the lungs.

Will you be kind enough to tell me where it was you anticipated annihilation?—I did not anticipate annihilation—it was a figurative expression, of course; in passing under the arches on the different parts of the line.

In going under the arches?—Yes.

All those evils will be considerably increased by the length of the tunnels?—Yes.

The longer the tunnel the more forcible all your objections?—Yes.

The principal objection is the change of temperature?—Yes; that and the reverberation of sound I consider almost the only objection.

You have been kind enough to write a book

for invalids and others who travel on the Continent; you recommend a journey to the Swiss mountains as good for invalids?—Yes.

Considerable changes of temperature take place in the valley of Martigny and on the mountain of the Great Saint Bernard?—Yes; but by that time they (invalids) have been inured to travelling.

Have you been through the Grotto Pausilipa at Naples?—Yes, I have.

The air is very warm at Naples at times?—Yes.

And this grotto is pretty nearly the temperature of the earth, and a quarter of a mile long?—Yes.

And have you heard of any serious effects occurring there from persons passing through that tunnel?—No; they do not go through it with rapidity; the rapidity of transit makes a great difference.

My learned friend doubts it being a quarter of a mile long; is it not rather more?—I am not sure of the length.

A good deal of rattling of carriages takes place there?—Yes; not so much as a train going through a tunnel.

Would you recommend persons with affections of the heart and head to travel at all, except by easy carriages?—Passive exercise, passing rapidly, would not injure them.

It would not be desirable for them even to go in a stage-coach, would it?—I consider all that passive exercise in which the muscles are not brought into action.

You think that such a person would not mind getting into a coach with four spirited horses, where they might be run away with?—They might mind it, but it would not hurt them unless they were run away with.

Do you know the Leicester and Swannington Railway?—No; I have never been on it.

Or the Leeds and Selby?—No.

Do you know whether the medical men have been more numerous in Liverpool and Manchester in consequence of the accidents in passing through the tunnel there?—No.

There have been no serious effects in passing through that tunnel?—No; I do not think that there is any danger in passing through it, because the engine goes slowly.

The change of temperature is the same?—No, I do not think that; it is eighty feet below the surface of the earth; I think it is a very superficial tunnel (the one next Liverpool), therefore it would be nearly the temperature of the surface of the earth.

How deep is it under the surface of the earth; I am told it is a considerable depth?—It did not strike me to be so either at the entrance or exit; it did not appear to me to be very cold.

What is the number of degrees you have given of the variation in the temperature?—The temperature of a tunnel eighty feet below the surface of the earth must be the temperature of that part of the earth, and in this climate it is fifty-two; supposing that it is thirty-two at the freezing point in winter and seventy-two summer heat, there would be a variation of twenty degrees in each case.

In the instance I gave of the valley of St. Martigny the variation would be more than twenty degrees?—It would be forty or fifty.

Re-examined by Mr. Waddington.

Do persons go from the valley of Martigny directly up the mountain of Saint Bernard?—No, they go very slowly.

Of course, the temperature decreases as you ascend?—Yes; the rapid transit through the air on a railroad carries off the heat of the body.

Then your ground of distinguishing those tunnels from that which my learned friend has asked you of the grotto of Pausilipa at Naples, is principally owing to the sudden transition and the rapidity with which they pass through them?—Yes.

The grotto at Naples is very lofty, is it not?—Yes.

As to those inconveniences being obviated by coats and cloaks, and so on, that is no reason why you would expose parties to the inconvenience which might be avoided by having an open railroad?—I think that those are the great objections which I have stated.

Dr. Anthony Todd Thomson, examined by Mr. Hill.

I am a physician in extensive practice in London, and professor of materia medica in the London University. Thirty-five years I have practised medicine. I have turned my attention to the subject of tunnels in railways that are intended for passengers, only theoretically. The difference of temperature between the interior of the tunnel and the outward air very much depends upon the depth of the tunnel or the space of earth which is above the tunnel; if that should be from sixty to eighty feet, it would make a considerable difference in the temperature, both in summer and in winter; more in winter than in summer: in winter in the interior the temperature will be higher than than that of the outward air, and in summer considerably lower. I think being suddenly plunged in this temperature by passing through a tunnel, would be extremely injurious to persons of susceptible habits, to dyspeptics, to convalescents from disease, and to persons affected with pulmonary complaints. I would certainly not permit, as far as my influence extended, my patients to go to Brighton by a tunnel railroad; I would prefer their going on the turnpike-road in the

common way, rather than encountering tunnels. A railway without a tunnel, inasmuch as the transit, does not produce much agitation of body, and is a better transit in point of speed, I think would be advantageous. Where persons are exhausted by illness, the shorter time you can have them upon the journey the better, other things being equal.

Cross-examined by Mr. Talbot.

There is a considerable vicissitude of temperature in the tunnel, which depends upon the depth below the surface of the earth; the lower the tunnel, or the greater the space above any tunnel of moderate length (not a very short tunnel), the more will it alter the temperature. Supposing that in the middle of the tunnel it is only eighty feet below the surface, but at the two entrances of the tunnel it is near the surface of the ground, that will alter the temperature at the extremities, but not at the centre of the tunnel. There is a considerable vicissitude in the temperature of a good cellar in summer; I do not think the better the cellar the greater the vicissitude; it is questionable whether the cooler the cellar the better; it is sometimes an object; but the great advantage of a cellar is to have it of an equal temperature in winter and summer, and therefore those cellars which are in the centre of houses are the best. It would materially affect the London and Birmingham Railway if there were tunnels upon it, if invalids were intending to travel upon it, but not as that railroad is chiefly intended for mercantile people and goods. They would be healthy passengers. I think the prejudice is much smaller on account of the tunnel in their case. If a man is in very good health, I do not think that there is much risk from passing through a tunnel of 600 yards; but, taking the average of human health, I think that there is some risk. The length of passage in a tunnel of 600 yards would be about a minute; it depends upon the rate of transit. The longer the tunnel and the deeper in the ground the worse it would be. I think that a cutting so long and narrow that the rays of the sun never penetrated to the bottom of it, would be prejudicial; nearly as bad as a tunnel.

Re-examined by Mr. Hill.

A cutting, however deep, would be open to the sky, but the change of air would depend entirely upon whether there was an opening below to that cutting; if there was an entrance from the side of the hill, and that upon an inclined plane, and then an opening rising to the top of the hill, that would produce a current of air. My mind was not turned to the nature of the openings and cuttings upon a railway. I am aware that it is proposed to make the cuttings of the railway without a tunnel at what is called two to one; that is to say, it slopes twice as fast as it rises; I did not refer to that sort of cutting, but to a well or a shaft. The cutting in the railway without a tunnel will not produce the ill effects of tunnels, or any thing like them. It is of very frequent occurrence with me to have patients who want to go to Brighton for the recovery of their health. As far as my experience goes, of late years more patients are sent from London to Brighton than to all the watering-places together almost; I therefore conceive a railway from London to Brighton, especially for persons going there for health, would be useful, and that it is of very great importance that there should be nothing upon this railway prejudicial to them.

Dr. Augustus Sayer, examined by Mr. Waddington.

I am a physician; I have practised in London about fifteen years, and am in the habit of sending patients to Brighton for the recovery of their health. Tunnel-travelling to Brighton being an innovation, I can only speak to it theoretically; for invalids it would be decidedly prejudicial. It would depend upon the nature of the illness or the state of the patient, whether I should advise him to travel that way; but, generally speaking, I would advise them to avoid it. The prejudicial effect arises from the transition from one state of temperature to another, and *vice versa*. I have some doubt whether the rapidity of transition would be prejudicial; but I have not sufficient experience upon that subject to form an opinion. It would be likely to produce colds and rheumatic complaints; I have never had an opportunity of travelling through a tunnel myself.

Cross-examined by Mr. Serjeant Merewether.

The only tunnel which I have visited is the one at Kensal Green; that is not in use.

John Propert, Esq., Surgeon, examined by Mr. Hill.

I have been a practical man in London twenty-five years; I have been practising myself twenty. I have thought a good deal upon the question of tunnels upon railroads. The result of my inquiry and reflection has been certainly not favourable with regard to passengers. I think the change of temperature which must be incurred by going through a tunnel will be unfavourable to the health of a person of delicate constitution, or suffering under disease; it would be trying to all. My attention has been directed to the passage of the steam-engine from Paddington to the City. From living in that part of the town,

I have frequently come into contact with it, and had to follow it; the burning of coke or coal, whichever they have, was, I should say, very prejudicial to health generally; but more so when that is confined within the walls of a tunnel of a certain length. I apprehend that it would be very difficult, or impossible, to ventilate tunnels properly. I can only speak theoretically; it has been found extremely difficult, and to a certain extent all experiments of the kind have failed; a tunnel never could be made perfectly clear of noxious air, arising from the passage of the steam-carriage. If my patients asked my opinion, I should decidedly object to their travelling through a tunnel to Brighton. I think that the time is immaterial, or that it does not make any great difference; at all events, I should say the impression that might be made by half a minute or a minute might be equal in a debilitated constitution to the effect produced in half an hour; but I should think that that was enough for a debilitated constitution to receive an unfavourable impression, so far as a debilitated constitution was concerned. I have known individuals who have attended funerals, going down into the vault under the church, which is tolerably well ventilated—I have known instances in which persons have caught so severe a cold that they have lost their lives; not from the fetid atmosphere, but I should say from the change of temperature. A railroad constructed from London to Brighton without a tunnel, from the shortness of transit, the freedom from dust and from the shaking motion which it would have on the turnpike-roads, however well made, would render such a mode of conveyance very valuable for invalids and persons in an infirm state of body. I would consider a railway without a tunnel much better than the present mode of conveyance, but a railroad with a tunnel much worse. The quickness of travelling is very desirable to persons in a state of convalescence; when that can be done without the injurious effects of tunnels, in my opinion, it is desirable, but I would rather prefer any way to that by tunnels.

Cross-examined by Mr. Wood.

I do not say that the duration of time is of no consequence, but I think that a minute is certainly long enough to receive an unfavourable impression. To say that immersion, when coming out immediately from the water, will be found beneficial, when remaining in the water, will be injurious—is not a parallel case. I differ from Dr. Johnson, who said that he did not at all look to the smoke of an engine; I think that it is of sufficient importance to be considered; I speak from experience. I do not know whether the steam-carriage from Paddington runs with coal or coke; one is equally prejudicial as the other. I have not been upon a railroad. I have never had a tunnel case.

By Mr. Taylor.—I would not recommend patients to go through a tunnel to Brighton; it would not be beneficial for the health of delicate persons to go a considerable distance through a swampy and marshy country very liable to fogs and floods—but I should not consider that equally injurious to a tunnel. I think the smoke would produce the effluvia in a tunnel, and the damp atmosphere. I cannot say whether the most solid and dry material will produce less of that damp and unpleasant effluvia.

Richard Clewin Griffiths, Esq., examined by Mr. Waddington.

I have practised in this metropolis about twenty-four years. I frequently send invalids to Brighton for the recovery of their health; I would certainly not send them if they had to travel by a railroad in which there were tunnels. Last year at this time I went through a tunnel between Whitstable and Canterbury, and the conductor told us to put all the blinds up, as we should experience great cold; that is worked by a stationary engine. The whole distance, which is six miles, was performed in half an hour. I was in the tunnel, I should think, three minutes; the distance is about 900 and odd yards; perhaps a few more or less. I put on my great coat, but did not button it; and we did not pull up all the blinds, and we entered the tunnel not feeling it, so that there was apparently no current of air of any consequence by which we could form a judgment that we should be inconvenienced; but when we had entered the tunnel I was obliged to button my coat and put my handkerchief round my neck, and we put up all the blinds but one; there was a tremendous current of air. The moment I got into the tunnel I felt the strongest wind that I witnessed in my life; it produced a catarrh, and the glands in the neck swelled; this inconvenience lasted about two hours. Had I been subject to any inflammatory disease in the eye, or any part exposed, it would have recurred I suppose. I should not recommend any of my patients to go through a similar tunnel, unless they were closely covered up.

Cross-examined by Mr. Goldsmid.

I did not experience a serious illness after passing through this tunnel; I cannot form an opinion as to whether the same effect would have been produced if you had been but one minute in it. We felt it to a greater extent, all the blinds not having been drawn up, but it felt also very cold with the windows up; the blind put up was either a cotton or linen blind; glass would have kept

out the cold more perfectly. The sensation of a current of air is felt going in any open steam-carriage; the sensation of the current of air is felt when you put your hand into the open air beyond the line of the carriage that is conveying you. This is the whole of my experience of tunnels. I did not hear whether any other passengers suffered severe illness; several complained of the cold for a few minutes.

Re-examined by Mr. Waddington.

My brother was with me upon this occasion; he felt very cold, as I did, but it did not produce catarrh. It was about this time last year, on an intensely hot day.

DEFEAT OF THE STEAM-CARRIAGES' BILL.

We are glad to find that this Bill—to the iniquitous partiality of which we were the first to draw the attention of the public (see *Mech. Mag.* p. 199)—has, after passing the Commons, been thrown out by the Lords. On its being presented to the Upper House, it was, on the motion of the Marquis of Salisbury (who has done himself much honour by his spirited conduct in the matter) referred to a Select Committee, who, after a full investigation into the merits of the case, made the following Report:—

Report from the Lords' Committee appointed to consider the Bill entitled "An Act to Repeal such portions of all acts as impose prohibitory Tolls on Steam-Carriages, and to substitute other Tolls on an equitable footing with Horse Carriages;" and to report to the House.

Ordered to report,—

That the Committee have proceeded to the examination of witnesses on the Bill referred to them, and have to report to the house, that the evidence of the principal engineers who have turned their attention to the construction of carriages propelled by steam upon the highways proves that very considerable progress has been made towards their perfection, and that they can travel with great rapidity.

The noise and smoke attendant upon their use have been very materially diminished; but it has been shown in evidence that they still have the effect of terrifying horses, and that accidents have occurred in consequence.

Much conflicting evidence has been tendered to the Committee as to the safest shape and the proper limitation of the size of vessels for generating steam to be used in these carriages. *All the witnesses,* however, agree *that in whatever shape the boilers may be made, their size should* be such as would in case of explosion not endanger the safety of the public; and the Committee do not feel themselves at present competent to come to such a conclusion on these two important points as would enable them to recommend the necessary enactments, if it was found expedient to proceed further with the Bill.

No adequate means have yet been provided effectually to guard against the emission of sparks from the chimneys of the engines which would guard effectually against the danger arising from them, although, with proper care in the selection and preparation of fuel, it does not appear that the danger is very imminent.

It also appears by the evidence of some of the witnesses examined, that although the management of the carriages is by no means difficult when under the superintendence of an experienced conductor, yet that they require much greater skill than is necessary in the management of locomotive-engines upon railways: and to find persons properly qualified might be a matter of considerable difficulty.

It is essential that the weight and size of the carriages to be employed should be regulated, so as to prevent their being made of that weight and size which might prove destructive of the roads and a serious nuisance to the public.

It appears also that the tolls intended to be imposed by the Bill are calculated upon an erroneous view of the powers of a horse. The rate of toll is calculated upon the supposition that each horse is able to draw a ton weight; whereas it is shown that a horse cannot, at a rapid pace, upon ordinary roads, draw more than half that weight.

The Committee entertain serious objections to the Bill referred to them; and they are not of opinion that these objections are counterbalanced by the prospect of any public advantage. The evidence, on the contrary, proves that the proposed mode of conveyance can only be applied to passengers; and it appears that some experienced engineers, after a careful examination of the expenses attendant upon it, have been induced to abandon all hopes of its success as a profitable undertaking.

It is probable, therefore, that any encouragement on the part of the Legislature would only give rise to wild speculations, ruinous to those engaging in them, and to experiments dangerous to the public. The Committee, therefore, recommend that this Bill should not at present be proceeded with; at the same time, they have no doubt that the further imposition of prohibitory tolls in local acts is not a desirable mode of legislating upon such a subject.

And the Committee have directed the evidence taken before them to be reported to the House, together with the index thereto.

NOTES AND NOTICES.

The new Statue of George III.—Mr. Cotes Wyatt's statue of George III. was on Wednesday (Aug. 3) erected in Pall Mall East, on the site chosen by the Commissioners, and opposed by Messrs. Ransom and Co., the bankers, opposite whose house it now stands. Sir F. Trench entered at some length into a detail of the circumstances connected with the statue. He stated that the Committee had guaranteed the artist 4,000*l*., although their subscriptions, with interest, amounted to no more than 3,100*l*. Chantry received 8,000*l*. for the statue of Sir T. Monro, a work of the same size; the equestrian statue of George IV. cost 9,000*l*.; the statue of the Duke of York on his column, 7,000*l*.; the equestrian statue at the end of the Long Walk at Windsor, 30,000*l*.; and the bronze figure of Achilles in Hyde Park about the same sum.

Consumption of Opium in China.—"It is a curious circumstance," says the *Quarterly Review*, "that we grow the poppy in our Indian territories to poison the people of China, in return for a wholesome beverage which they prepare, almost exclusively, for us." From the following statement made by Mr. Davis, late Chief Superintendent at Canton, it appears that the money laid out by the Chinese on their favourite drug far exceeds what they receive for their tea:—

Imports in 1833.	Dollars.
Opium	11,618,167
Other Imports	11,858,077
	23,476,244

Exports in 1833.	Dollars.
Tea	9,133,749
Other Exports	11,309,521
	20,443,270

The Chinese smuggle all this opium, and pay the difference between the price of it and that of the tea they export in silver.

New Locomotive-Power.—Mr. Mullins, M.P. for Kerry, has made a very important discovery in the scientific world, that of applying galvanism, instead of steam, for propelling vessels and carriages. He is now building a carriage upon his principle, and several of the first engineers, who have seen it, say there is every prospect of success, and that it will supersede steam.—*Limerick Star*. The *Dublin Evening Post* claims the merit of this invention for the Rev. J. W. M'Gawley, who, it will be remembered, brought forward something of this kind at the meeting of the British Association of Science in Dublin last August.

Nettles.—In Scotland I have eaten nettles, I have slept in nettle sheets, and I have dined off a nettle table-cloth. The young and tender nettle is an excellent pot-herb, and the stalks of the old nettle are as good as flax for making cloth. I have heard my mother say that she thought nettle-cloth more durable than any other species of linen.—*Campbell in the New Monthly*.

On Monday se'nnight, Mr. Pocock, of Bristol, passed through the town of Chippenham in a carriage drawn by two air-kites, occasionally travelling at the rate of 25 miles per hour. In the vicinity of the town he was detained some time in consequence of the web getting entangled in a tree. —*Salisbury Herald*.

M. Gambart, the astronomer, Director of the Marseilles Observatory, and a correspondent of the Institute, died a few days ago at Paris. This gentleman is well known in the scientific world for his *frequent* discoveries of comets.

Aeronautic Observations.—Since Mr. Green's first attempt at ballooning he has travelled through the air above 5000 miles, having made 218 ascents, and has had a bird's-eye view of every part of England. On the last occasion, when Lord Clanricarde went with him, he observed that surveyors and architects could with greater facility take plans of noblemen's estates by ascending in a balloon, as they could have a bird's-eye view of every locality, and if they only once adopted that method they would never relinquish it. Since the suggestion an artist named Burton called on Mr. Green to obtain him the plan of a balloon constructed so as to act in the above way, it being connected to the car by a swivel. The inventor proposes to build a waggon, for the purpose of fastening a balloon to it, which, when filled with gas, which can be done in various parts of the country at gas company's gasometers, may be conveyed to any place a surveyor requires, where, on a calm day, he can take plans, carrying with him the proper instruments. The balloon will then be fastened by ropes to the spot most favourable for observation, and raised to an elevation of 300 or 400 feet, as necessary. In this way a bird's-eye view can be taken of any town or city. Mr. Green is willing at any time that his balloon, by way of experiment, may be made use of in that way.—*Globe*.

"A patent has been granted to a Mr. C. P. Devaux, of Fenchurch-street, for a new process of smelting iron ore, &c. I shall be much obliged to any of your correspondents who will inform me where this new process has been tried, and what are the results? You will not, I trust, refuse a conspicuous place in your valuable journal to these inquiries, in which so many of your friends in the North are interested.—PIG-IRON, July 7, 1836."

Brick-Making Machines.—"Sir, observing in your Magazine a description of a brick-making machine invented by Mr. Heaton, of Birmingham, I take the liberty of informing you that I have the plans of a machine for a similar purpose, with which I propose to make 100 bricks per minute. Should any one be desirous of obtaining further particulars, a note addressed to J. C., 2, Lower Brook street, Bond street, will be attended to by yours obediently, A LOVER OF MECHANICS."

Mr. Dickson's reply to the Cornish Engineers in our next; also, rejoinder by Kinclaven to Ursa Major, and reply by Mr. Symington to Mr. Howard.

The general title of the invention is all that is necessary in a caveat.

Communications received from J. K.—Mr. John Thomas—Mr. Clark—T. R. Croft—Mr. Landale—Mr. V. W. Gardiner—E. V.—Mr. Douglas—Mr. Curtis—Mr. Pole—J. L.

The Supplement to Vol. XXIV., containing Title, Contents, Index, &c., and embellished with a Portrait of Mr. Walter Hancock, C.E., is now published, price 6*d*. Also the Volume complete in boards, price 9*s*. 6*d*.

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CURTIS'S IMPROVED CHIMNEY-HOOD

AND

ASH-PAN FOR LOCOMOTIVE-ENGINES.

CURTIS'S CHIMNEY-HOOD AND ASH-PAN FOR LOCOMOTIVE-ENGINES.

Sir,—I send you a drawing and description of my chimney-hood and ash-pan for locomotive-engines, as used on the London and Greenwich Railway, and shall feel obliged by your insertion of the same in your valuable pages.

The Hood.—The chimney of the engine is covered with a dome, which projects the steam and heated air escaping into the atmosphere upon a surface of water contained in the receiver or outer vessel, so that any sparks or other matter ejected from the chimney must necessarily be received in the water, and consequently extinguished. The condensation of the steam, together with the priming of the boiler, supply sufficient water to keep the bottom of the receiver always covered; and for the purpose of carrying off any excess of water, a small tube is fixed to the bottom of the receiver, and this pipe stands up about 1¾ of an inch, so that a plate of water of 1¼ inch deep is always ensured. The pipe enters the chimney and forms an elbow, which elbow also is always full of water, so that no fire can possibly pass through it. It is my intention eventually to form the dome double, and to pump up the cold water, which will be thus heated by the waste steam, and then to pump this heated water into the boiler, thus converting the apparatus into a feed head. I find a space all round of about four inches sufficient for the passage of the steam, &c. I have put this invention to the most severe tests I could devise, but could never force a spark from the chimney. The engine runs freer and faster than with the gauge, the draught is unimpaired, the apparatus is cheap and simple, and absolutely safe.

Description of Engravings.

Fig. 1 is a section, and fig. 2 an elevation of the hood: *a*, chimney; *b*, receiver, containing water; *c*, dome or hood; *d*, bent tube; the curved arrows show the path of the steam, air, &c.

The *ash-pan* is a box of sheet-iron suspended under the fire, and water-tight, so that the water filtering through the fire-box *a* is received into it. The pan is about eight inches deep, and the sides rise above the fire-box about three inches all round, so that the dust in the act of falling is not blown away during the progress of the engine, or by the wind, and being received into water is, of course, immediately extinguished, while the water is evaporised; and the vapour not only prevents the coke from clinkering on the bars, but materially assists the combustion. The box is open all round and behind about eight inches, thus providing abundant area for the passage of the air to the fire. It is suspended behind by a joint to the framing, and before by a chain which coils round the axle of the hand-wheel *f*, so that when the engineer wishes to discharge the ashes, or rake the fire-bars, he merely lets go the wheel, when the pan falls down, describing the curve shown by the dotted line.

Description of Engravings.

Fig. 3 is a section, and fig. 4 an elevation of ash-pan and part of the boiler: *a*, fire-box; *b*, boiler; *c*, fire-bars; *d*, ash-pan, containing water; *e*, hinge of ditto; *f*, hand-wheel; *g*, chain by which the pan is suspended. The curved arrows indicate the path of the air.

Your most obedient servant,
W. S. Curtis.

Deptford, August 6, 1836.

MR. SYMINGTON'S REPLY TO MR. HOWARD.

Sir,—Mr. Howard's communication contained in your last Number betrays such evident marks of being got up in haste, that I am certain by this time even Mr. Howard himself will scarcely deem it worthy of serious refutation.

I shall, therefore, content myself with referring such parties as may take an interest in the question to the drawings accompanying Mr. Howard's specification and to those in my circulars, where it will be found the difference between the two inventions is any thing but "*immaterial.*"

In one part of his letter Mr. Howard says, "I may add, that the process (his, I suppose) answers completely;" in reference to which I have merely to observe, that not being aware how far Mr. Howard's notions of completeness extend, I will not, for a moment, think of contradicting him, but briefly remind him, that the more simple any useful invention is, so much the nearer is it to perfection. Bearing this fact in mind, I fearlessly leave it to Mr. Howard's own judgment, whether he will venture to say that his invention is possessed of the greater simplicity.

One thing more, and I leave Mr. Howard calmly to reflect, whether it was fair to deal in assertions which he can neither substantiate, nor has taken due pains to ascertain to be well-founded: although such assertions might produce an unfavourable impression regarding the conduct of an individual to whom he was a stranger. He has ventured to assert, that I saw his process in operation at the King and Queen Iron-Works, Rotherhithe, upwards of two years ago; but this assertion is as erroneous as that he has anticipated me in my plan of condensation, for I can and do most positively affirm, that during the whole course of my life I never saw his principle, or method, or process, either at work or at rest; neither did I ever set foot within the walls of the King and Queen Iron-Works, Rotherhithe. So much for hasty conjecture! Unless Mr. Howard can disprove my positive affirmation, surely he cannot but regret having so phrased his assertion, as that it might tend to create suspicions of my being unprincipled enough to visit him for the purpose of surreptitiously depriving him of his plan of condensation.

Trusting you will oblige me by giving this insertion,

I have the honour to remain, Sir,

Your most obedient humble servant,

WILLIAM SYMINGTON.

1, King William-street, London Bridge,
Aug. 10, 1836.

THE ELECTRICAL THEORY OF THE UNIVERSE.

Sir,—I am somewhat inclined to think that your correspondent, Ursa Major, and your humbler servant, Kinclaven, are old acquaintances; however, be that as it may. It appeared from his first article on the Electrical Theory of the Universe, that he was a waverer between the Newtonian and Mackintoshian theory; but, from his last, he appears to be about three-fourths charged with electrical fluid, and no doubt one lecture more will make him brim-full. He informs me that he is no stranger to the demonstrations that have been given on the general law of the tides by all the great mathematicians (La Place included) who have lived since the days of Newton; and he *very modestly* requires me *to "translate their* demonstrations into *the language of common* sense." That is, in plain English, he (Ursa Major) having neglected to cultivate those talents with which Nature has gifted him, would wish me to show him some "royal road" to physical astronomy that would shorten his journey.*

Mr. Mackintosh informs us (No. 645) that his theory is in accordance with Kepler's laws. And again, in No. 655, he states that our earth must at one time have been attended by at least five moons. We shall see how this agrees with one of Kepler's laws, namely, that the squares of the periodic times are as the cubes of the mean distances from the sun.

Let t and T be the periodic times of two planets, d and D their mean distances, v and V their angular velocities. Then, by Kepler's law, $t^2 : T^2 :: d^3 : D^3$; also, from the laws of central forces, $t^2 \doteqdot \frac{d^2}{v^2}$ and $T^2 \doteqdot \frac{D^2}{V^2}$, hence $\frac{d^2}{v^2} : \frac{D^2}{V^2} :: d^3 : D^3$, from which it follows, that $dv^2 = DV^2$. Again, Mr. Mackintosh informs us, that the paths of all the planets are becoming nearer and nearer into circular orbits, and —ultimately they will all be whirled into the body of the sun. Supposing this to be the case with the planet whose present mean distance from the sun we have designated by the symbol d; then when that event takes place, $d = o \therefore dv^2 = o$, but when d ceases to exist so must $v^2 \therefore v^2 = o$; also since $dv^2 = DV^2$, therefore $DV^2 = o$, hence one of the factors D or V^2, or both, must be $= o$; if $D = o$, then the angular velocity V ceases $\therefore V^2 = o$. Again, when $V^2 = o$, it follows, either from the laws of gravitation or the electrical theory, that if D is not $= o$, it will quickly be so, for the planet then would be only acted upon by a centripetal force; and it would be contrary to either theory to suppose that the second planet (when $V = o$), like Mahomet's coffin, could be suspended in mid-heaven. It therefore follows, that if Mr. Mackintosh's new theory is in accordance with the law of Kepler—when one planet is destroyed, all the rest will almost immediately share the same fate—the same reasoning may be applied to the case of the five supposed moons, but as we are

* Ursa Major, I presume, has not read Professor Airy's little work entitled "Gravitation," which was noticed in the Mechanics' Magazine more than a year ago. I would recommend him to read it, as it is well adapted for those who are not deeply read in mathematical science.

sure one of them still continues to exist, it will be useless to add any more on this head; in short, hundreds of reasons might be urged against the electrical theory, and all deduced from well-established facts.

I am, Sir, yours, &c.
KINCLAVEN.

Aug. 9, 1836.

MR. DICKSON'S REPLY TO THE CORNISH ENGINEERS.

Sir,—In the observations (No. 675) on my letter to you (in No. 669), the writer begins with the verb *to be*, or the difference between the word *was* and *is*. So little is this difference, that this *was* and *is* is not the word that I alluded to, for it *was* and *is* the application of the definite article *the* to the noun *nursery* (in place of the indefinite *a*), which intimated that Cornwall *was* and *is* the only nursery for steam-engines. I assure you, sir, I had and have no wish to offend any one, either in word or deed; besides, I am not the only person who have taken notice of the glaring improbabilities set forth with respect to Cornish steam-engine work. The writer complains of my not addressing myself to him as taking upon himself to be the champion of the Cornish engineers; but this I must decline, because my remarks appertain generally to so many persons whose names have been attached to the accounts of different performances for several years past.

Mr. Enys has not given any other reason for the increase of duty, but repeated that it *was* and *is* from the improved pit-work and their *complete* system of clothing, together with the use of high steam used expansively, that they have been enabled to do so much with a bushel of coal. Now all these they have had, now have, and shall have in future; nevertheless, I repeat my protest with all that accompanies it in my letter, dated May 25, 1836.

The writer says, that Mr. Watt's amount of duty was obtained by the same mode of calculation as that used to obtain the others, adding the following words:—"admitting that both are subject to the well-known error of a result higher than the actual delivery of water." Now, sir, after this I hope you will perceive that the incorrectness and carelessness which the writer has attributed to others, belong entirely to himself and party, and that they only are in difficulties, and although "they regard with the utmost apathy the opinions or assertions of engineers of other parts of the kingdom," perhaps the public will not do so, because controversy has often been the means of arriving nearer to the truth, and this *was* and *is* the reason why I wish them to begin their calculations again, taking truth or facts as the foundation,—to depart from the unit, and in place of a hundred millions raised one foot high, let us have a million of pounds weight raised a hundred feet high, &c. The writer also states, that at certain mines from a comparison of two different years there was a great difference in the quantity of coal paid for, and that "the water delivered was assumed to be the same in both years." Now this is rather too bad—even to discard calculation, as well as their admitted "well-known errors," which have assisted them in showing their hundred and odd millions. Whatever erroneous calculations cannot do, assumptions of course will easily accomplish. Every engine-worker knows that his engine (if in good order) will only consume coal in proportion to the work done; and I presume it will not be denied that most of the water raised from mines first descends from the surface of the earth in spite of the precautions used to prevent it; consequently a rainy season often makes a great difference. In some districts there are mines to be found where the water is drawn from about three-fourths of the depth, while in the lower quarter scarcely any water is found. Suppose, for instance, any of the clever men, since Mr. Watt, had been able to enforce the payment of a portion of the savings that has been effected, would the proprietors have quietly submitted all this time to the accounts being all on one side? Some that I have spoken to, say no; and farther, that we should never have heard of their ten-times-ten millions, and so forth, if there had been any opposite interest to contend with. The writer speaks of the difficulty of measuring water from different levels; but from the average surface of the water in the sump, or place from which the pump draws it to the point of delivery, I believe is what ought to be taken, and they cannot all be such cramped holes in Cornwall, that a couple of cisterns cannot be put or formed in the strata, each to hold a few minutes or hours' delivery of the water from the

pumps. This once done and attended to, no algebra, and very little arithmetic, would be wanted to set all contentions at rest.

I am glad, however, that I have not interfered with the mode of showing the great increase of duty; they are at liberty to generate their steam as cheap as they can, to raise it as high as they choose, and afterwards to allow it to expand to the uttermost point, and at last condense it in any way, being always clothed in their own garments,—with all these appliances, if they can prove what they have asserted, it would be a great national benefit, an honour to Cornwall, and I should be satisfied with being the means of causing others to perform a meritorious task. With these sentiments I leave this subject in the hands of those to whom it belongs; and when these proofs are forthcoming, they will of course be published in the *Mechanics' Magazine.*

Your obedient servant,

J. Dickson, C.E.

9, Charlotte-street, Blackfriars-road,
August 5, 1836.

FALLACY OF JONES'S MERCURIAL STEAM-WHEEL.

"Oh wonders, sure, will never cease,
While works of art do so increase."
Song—The Steam Arm.

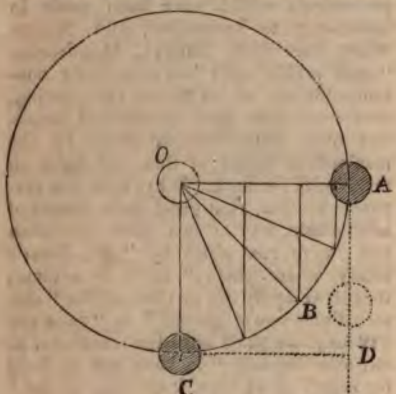
Sir,—I have lately commenced taking in your periodical, and from the excellent articles I have observed in it, I have regretted that I did not begin at an earlier period. I have particularly noticed the readiness you manifest to give publicity to any remarks on any inventions at all calculated to forward the interests of mechanical science in the world; and as I apprehend your columns are equally open for strictures upon such inventions when they are not valuable, I have troubled you with a remark or two upon one, I perceive, in your last Number, viz. "Jones's rotary mercurial steam-wheel," which is stated there to possess some marvellous advantages over the common steam-engine; indeed, I was induced to look at it more closely than I otherwise should have done, by observing towards the end of the article the startling assertion (startling, at least, as I think it must be to all who have been accustomed to take the acknowledged rules of mechanics as their *guide*), that this wonder*ful discovery completely* overturns the *old and absurd notion,* that to produce a certain effect an equal power must be applied in some shape or other; or, as Mr. Jones expresses it, "if we wish to raise five tons at one end of the beam, a corresponding pressure must be made on the other end or piston;" and this notion, I say, has been completely exploded; for now we have only to raise 112lbs. to increase the mechanical effect nearly sixteen times.

Surely, Mr. Editor, this invention must put to the blush all the paltry little improvements which have been made in steam-engines heretofore; and Messrs. Watt, Trevithick, Murray, Maudslay—"*cum multis aliis*"—with their contemptible 25, 50, or 75 per cent. saving, may now hide their diminished heads, and own themselves out-shone by the resplendent lustre of this new light in mechanical science. Why, even the perpetual motion, that great *ignis fatuus* of mechanists, has at last been *overtaken* and *fairly run down* by "Mr. Jones's rotary steam-wheel;" for it is evident, that if we apply two or three of the "sixteen times power gained" to "raise the 112lbs.," we shall have the remainder at our own disposal "to have and to hold for ever," or at least "so long as the" machine "endureth."

And, sir, can sufficient be said in praise of the philanthropic discoverer of this great "wheel of fortune," who, instead of aggrandising himself by patenting his invention, generously throws it open '*pro bono publico?*"—ought he not to be classed with Howard and other individuals who have disinterestedly devoted their time and talents to the public *weal,* and to have his memory immortalised by a monument (surmounted, I would say, with a figure of *Mercury,*) in Westminster Abbey?

But, Mr. Editor, lest these honours should be surreptitiously obtained, it may be worth while to inquire whether "Jones's rotary mercurial steam-wheel" do in reality possess such surprising properties as those attributed to it;—I think upon investigation we shall find that it does *not*—and that in point of fact, it falls woefully behind even the common engine of the old construction. We will pass over the merits or demerits of the steam-wheel *as a machine,* and suppose it in action, in order that we may examine the calculation of its effect. And here I would observe, that Mr. Jones has committed two great errors; first, in sup-

posing that he would have a power of 112lbs. *constantly acting at the horizontal extremity of his wheel;* and secondly, in not taking into calculation the space through which his weight is raised, when he estimates the useful effect of his machine. These points, I think, will require very little explanation. With regard to the first, it must be evident that if a weight descend through the quadrantal arc of a circle, in the direction of A B C, it will



not have so great effect to turn the spindle O, as if it were constantly acting for the same length of length at the point A. (To illustrate this latter case, the circle in the figure may be supposed a pulley, over which a cord passes, having a weight hung at its extremity, the weight descending through a space equal to the length of the arc A B C—see the dotted lines.) The force, on the contrary, must be continually diminishing, as the versed sine of the arc passed through increases, and the real measure of such power will be obtained by considering the weight to have moved through a space equal to O C or A D; for as gravity is the motive-*power, the distance* traversed in a *vertical direction is all that* can be estimated as *effective, and not the* whole length of the *arc, as given* by Mr. Jones. The real *effect, therefore,* will be 112lbs.—moved through two feet for each arm of the wheel—supposing it to be four feet diameter.

Then, secondly, the space through which the weight is raised ought to have been taken into consideration in estimating the effect of the wheel. Mr. Jones has stated his calculation in so complicated a manner as to render it a complete mystification (which, by-the-bye, Mr. Editor, your Mephistophiles has in some degree assisted by making one or two mistakes, as 1·1416 for 3·1416, and 1,780 feet for 1,780lbs). He certainly introduces something about 7 feet—112 fathoms, 672 feet—864 revolutions, and a number of other figures, which do not seem to have any thing to do with the subject in question; but from all this he deduces (in a manner which he does not explain) an inference, which is, that a cubic foot of steam will raise 445lbs. True, and so it might be made to lift 445,000lbs., but how high? His 445lbs. (as far as I can make out the calculation) is not raised 672 feet, nor 7 feet, nor even 1 foot, but only about 9·4 inches! being the circumference of the axle 3 inches diameter. This ought to have been noticed, otherwise Mr. Jones might increase the power of his or any other wheel *ad infinitum* by merely diminishing the diameter of the axle; but it is one of the first principles in mechanics, that nothing is in reality gained in that way, as although a *greater weight* may be raised on the smaller axle by a given power, the said power must pass through a proportionately *greater space* in raising it, or, as the adage says, "What is gained in power is lost in time"—the momentum (or = force × space passed through) of the power raising being always equal to that of the weight raised.

Let us now try if we cannot find out the power of the steam-wheel in a more simple way, and we will take the data furnished by Mr. Jones himself, viz. the wheel 4 feet diameter, each vessel to be of the capacity of 1 cubic foot, and 112lbs. of mercury to be used; we will also supply something he has omitted, viz. the pressure of the steam, which, as the mercury is to be raised something above 2 feet vertical height, must be at least 14 or 15lbs. effective force per square inch, say 14lbs. Mr. Jones has nobly allowed 12lbs. (!) for the friction of his machine; but we will go further, and, in order to give him the full benefit

of his invention, suppose no friction at all.

We have seen a little way back, that the effect produced by one quarter of a revolution of the wheel (or the action of one arm) is equal to raising 112lbs. through 2 feet; and as 1 cubic foot of steam is consumed in the operation, the mechanical effect of the said foot of steam in this wheel will be represented by $112 \times 2 = 224$. Now, let us see what the same quantity of steam of equal pressure will do in the common engine, constructed according to the principle of "making a corresponding pressure on one end of the beam to raise a certain weight at the other." Suppose a cylinder 144 inches area, and let the piston move through a space of 12 inches, this will evidently consume 1 cubic foot of steam; and multiplying the area by the pressure per square inch, we have $144 \times 14 = 2016$lbs. raised 1 foot, for its effect in the "present engine" being 9 times as much as in the "rotary mercurial steam-wheel."

I think, Mr. Editor, this result will be sufficient to dispose of the invention (and I very much doubt whether it will ever be *disposed of* in any other way), without saying any thing of its mechanical defects; but I would recommend Mr. Jones, if he wishes to apply the power of steam in conjunction with the action of a heavier fluid, to look at a wheel for that purpose described in either Stuart's or Partington's "History of Steam-Engines"—I think the latter—which is a much better thing than his may ever hope to be, but which has not yet superseded the "present engine," nor do I think it ever will do so.

In conclusion, I would warn any unlucky wight, "who has got a spirit of mechanical inquiry and speculation," from laying out much money in trying this wheel, as instead of (as he may fondly hope) his advances returning to him *sixteen fold*—he will most assuredly, sooner or later, find himself in the same predicament as a brother mechanic in Germany, of whom we read in the companion song to the one quoted in our motto, that

"No cash did the artist e'er requite,
He never got paid—*and it served him right.*"

Your obedient servant,

William Pole.

Winsley-street, Aug. 10, 1836.

A NEW THEORY OF THE TIDES.

Sir,—I have noticed the several articles on the tides in your late Numbers, and cannot help thinking the double diurnal rising of the waters of the ocean may be explained on very simple principles, notwithstanding the apparent difficulty of the subject, and in perfect accordance with the Newtonian theory of universal gravitation and the central forces.

It is eight or ten years since the following idea occurred to me. I had not then met with any satisfactory explanation or theory of the tides, and the idea appearing to my mind so clear, I mentioned it to some of my scientific friends. The notice recently taken of the subject of the tides in your valuable Magazine, has not only recalled that idea to my memory, but has suggested the possibility of making a machine to give ocular demonstration of the double diurnal tide.

For the purpose of literal demonstration, let us suppose that the distance of the earth's centre from the centre of the moon is 240,000 miles, that the diameter of the earth is 8000, and that of the moon 2000 miles, and that they are dense in proportion to their sizes. Then as globes are to each other as the cubes of their diameters, the density of the earth will be sixty-four times that of the moon, and the centre of gravity of both sixty-four times nearer the former than the latter. This point is within the body of earth, or about 3750 miles from its centre. The moon is said to revolve round the earth, in which saying there seems no impropriety; but for our purpose it is necessary to state that, strictly speaking, these two bodies revolve on the above point, which is the centre of gravity both combined. The above numbers are not correct, but they are sufficient for our purpose.

The centrifugal force, created by the revolution of the earth in this small orbit round the combined centre of gravity of the earth and moon, will have a constant tendency to make the earth fly off from that centre, which she would do if it were not for the attraction of the moon acting with equal force in a contrary direction. The earth is therefore between two forces, and being partly fluid, the fluid parts are elongated in the direction of these forces. This elongation constitutes the double diurnal lunar tide, which flows in a contrary direction to the diurnal

motion of the earth on its axis. Now for the solar tides.

According to the law of universal gravitation, every particle of matter of the terrestrial globe will attract every particle of matter in the lunar globe, and *vice versa*. The attraction between these bodies may be compared to a chain binding them together, every link of which sustains the same strain, for a chain freely suspended between two points cannot have a greater strain at one part than another (barring weight, which in this case it is supposed to be devoid of). The attraction at the moon must therefore be exactly equal to that at the earth, and as the centripetal and centrifugal forces are always equal and contrary, they must produce results on the moon's surface similar to the terrestrial tides, provided that luminary be surrounded with fluids like the earth. Apply this doctrine to the earth as influenced by the sun, and the effect must be a double diurnal solar tide on the earth.

The spring tides are caused by the central forces acting parallel and in unison at the fulls and changes of the moon, and the neap tides by acting at right angles or in opposition to each other at the quarters.

From what I have said it might be supposed we have four diurnal tides, viz. two solar and two lunar; but this is not the case, the sun's influence being much smaller than that of the moon, perhaps in the proportion of 1 to 5. The solar tide combining with the lunar, becomes evanescent, and will be best shown by figures as follows:—Supposing the lunar tide at any particular place to rise 15 feet, nd that at the same place the solar tide rises 3 feet, then when the moon is at the full or change, and her attraction acts in conjunction with the sun's, we shall have $15 + 3 = 18$ feet, or a spring tide; but when the moon is at the quarters and acts in opposition to the sun, we shall have $15 - 3 = 12$, or a neap tide.

Should the machine I have planned answer the purpose of ocular demonstration agreeable to what has been stated, you will hear from me again. I shall proceed to have it made and tried forthwith, and if it should appear worthy of being introduced into the schools of education, I will manufacture it for that purpose.

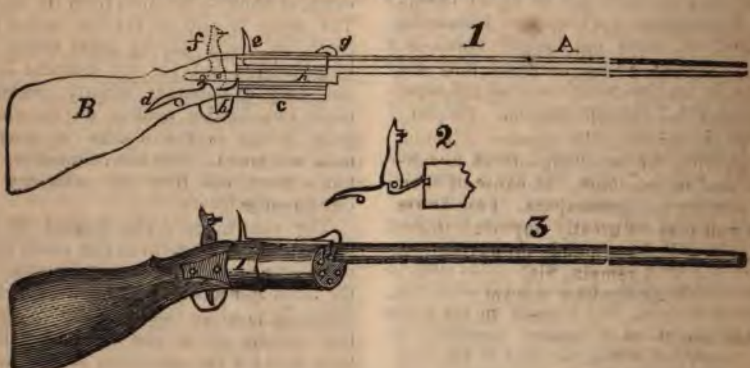
I have endeavoured to be as concise as possible, which is consistent both with your pages and my avocations.

I am, &c.

ALEX. CLARK, Engineer.

7, Nelson Terrace, City-road, London,
August 5, 1836.

ANCIENT GUN WITH REVOLVING BREECH.



Sir.—On entering the house of a friend (*Mr. Daniel Sankey*, of Colebrook Dale) *my attention was directed* to a singular-*looking gun*, which, on inspection, I *found to be a very old* one, with a revolving-breech, which may be fired six times in twenty seconds by only lifting the striker each time. So far it corresponds in principle with the one described in your valuable Magazine (No. 601, vol.

xxii.) and of which your correspondent thought himself to be the inventor. This gun was purchased at the sale of an old gentleman's effects in Gloucester many years ago, and he had used it for about half a century. I am informed that it is of Continental manufacture.

Fig. 1 is a longitudinal section of the piece; A is the barrel, which is of brass, with a bore of about three-eighths of an inch; B is the stock; *c* is the breech, about six inches long and two inches and a half diameter, made of brass; into it are drilled seven holes, six round near the ring for containing the charges, and one in the centre bored quite through to allow a kind of arm to the barrel marked *h* to enter the stock, to which it is fastened by screws. *d* is the main-spring, which operates on the striker *f* by means of an offset near its bottom. In firing the breech is turned round one-sixth of its revolution, and consequently one of its six holes, which are previously charged, is brought opposite the barrel every time the striker is raised by means of a small lever projecting from its lower extremity, and coming underneath a small spring-catch, as shown in fig. 2, the catch entering a recess in the breech when the striker is falling. *e* is the hen, or steel; it does not remain up after being struck, as in common guns, but rises a little, and is pressed down again by the spring *g*. There is a case of sheet brass, about two inches long, shown at I, fig. 3, with a prime-pan cut in it at top, in which the breech turns air-tight, and by this means the priming is not lost, and a communication prevented between one prime and another, which would be of serious consequence, and a deficiency on this point is, in my opinion, the greatest objection in applying the revolving-breech to cannon, and is, no doubt, the cause of their not coming into general use. I am aware this gun may be greatly improved in detail, but still the principle preserved.

I remain, Sir,
Your obedient servant,
JOHN THOMAS.

Redlak, near Wellington, Salop,
Aug. 3, 1836.

BRITISH MUSEUM.

We have already noticed the valuable labours of Mr. John Millard in reforming *our National Museum*, in rendering *it worthy of the country*, and in extending its public utility. The following petition, presented by the Chancellor of the Exchequer on Saturday last, will, we trust, secure for Mr. Millard that reward which his incessant and successful exertions so well deserve. *Palmam qui meruit ferat!* Many parts of the plan alluded to in the following petition have been recommended for adoption by the Committee in their recent Report to the House.*

To the Honourable the Commons of the United Kingdom of Great Britain and Ireland in Parliament assembled.

The humble Petition of JOHN MILLARD, of No. 34, Arlington-street, Camden Town.

Showeth,—That your petitioner is the author of a letter to the Right Honourable the Chancellor of the Exchequer, containing a plan for the better management of the British Museum; by the adoption of which your petitioner humbly conceives the public utility of this national establishment would be greatly extended, and the prosperity of our arts and manufactures materially improved.

That your petitioner, with a view thus to adapt the British Museum to the present advanced state of human science and learning, has, for the last three years, at considerable personal sacrifices, devoted the greater part of his time and attention to the collection of information both at home and abroad, which might tend to facilitate the labours of the Committee appointed by your Honourable House to inquire into the condition, management, and affairs of the British Museum; and your petitioner has reason to believe, that, without such aid on his part, the Committee could not have been put into possession of many important facts, the disclosure of which could not fail of producing the most beneficial results to the public.

Your petitioner, therefore, humbly represents these circumstances to your Honourable House, in the hope that your Honourable House will take such notice of his petition as to your Honourable House may seem meet.

And your petitioner will ever pray, &c.

JOHN MILLARD.

July 11, 1836.

SCHOOL OF DESIGN.

Our readers will be gratified to hear that, through the influence of the Chancellor of the Exchequer, a grant of 1500*l.* has lately passed the House for the establishment of a School of Design for the improvement of our national manufactures; and the following correspondence

* See Mechanics' Magazine, p. 285.

which has lately taken place will explain the views of the Government on the subject:—

"Office of Committee of Privy Council for Trade, Whitehall, July 11, 1836.

"Sir,—The attention of the Lords of the Committee of Privy Council for Trade has, for some time, been directed to the propriety of establishing in this country a School of Design in the arts connected with our manufactures. It has been, in some degree, a subject of reproach to this country, that although its manufactures have, in so many respects, excelled those of others, yet that in the beauty of design they are often inferior. This defect has been, in some measure, removed by the rivalry which the competition with foreigners has naturally excited. But from this class of art having been neglected, the progress of improvement has been less rapid, especially in the silk manufacture, than is to be desired; a fact which is chiefly to be attributed to the difficulty of obtaining suitable instruction in the principles of design and colouring, in relation to objects of manufacturing art. In consequence, their Lordships are informed, the supply of pattern designs for the use of the manufacturer would be very inadequate, if our artists did not copy the designs from articles of foreign manufacture, a practice which may be necessary as a substitute for original talent, but which is to be avoided if possible.

"But it is not only in the art of design, as connected with our manufactures, that we are inferior to some other countries; we are perhaps still more so in those accessaries of the art—viz., in the knowledge of the pictorial effects of colours, and the chemistry which it is necessary that the designer should be acquainted with, in order that he may not employ such as it will not be safe for the manufacturer to adopt.

"Their Lordships have had frequent consultations with numerous parties conversant with this subject, and they have come to the conclusion that it is desirable to establish in this country a Normal school of design, in connexion with a museum, and with provision for a scheme of lectures which shall embrace the art of colouring, and the chemistry of colours. They have many reasons to think that private subscriptions will be raised, in order to extend, and ultimately, perhaps, almost entirely to support, such an establishment; but, in the first instance, they consider that it will be necessary to apply to Parliament for assistance, in order to give the undertaking a more national character, as well as to cover the extraordinary expenses which must attend its first formation. They, therefore, submit to the Lords of the Treasury their request that the sum of 1500*l.* may be applied for to Parliament in this year.

"The manner of carrying the plan into effect, their Lordships propose to intrust to a body of persons of competent judgment in the arts, subject to such regulations as their Lordships may think most proper to impose, for the due administration of the grant which may be made out of the public revenue.

"Their Lordships are of opinion that the establishment of the proposed school should consist of the Curator or Director, and two masters, with one or more attendants. The duty of the Curator will be to select proper objects for the museum, and to submit estimates of the expense to the Lords of the Committee of Privy Council for Trade to take charge of such objects, whether purchased or presented, and, above all, to give, at stated periods, by way of lecture, instruction on the specimens to the scholars generally, to which lectures the public shall have the right of admission on paying a small fee.

"The two masters should be of a different order of attainments, and employed accordingly.

"It is proposed to divide the school into four classes, of two of which the initiatory teacher should have the charge, the principal teacher having the charge of the others.

"The classes of the initiatory teacher will be,

"1st. Of drawing in outline perspective, and drawing-board practice.

"2nd. Of the same, with the addition of light and shade.

"The classes of the principal teacher will be,

"3rd. Of the above, with the addition of water and body colour.

"4th. Of composition and imaginative design generally.

"It is supposed that the scholars who will apply for admission in the first instance will draw moderately well, and that of them there will be a sufficient number to make at once a class of each description.

"But it may be necessary, in addition to the above provision of two teachers, to provide for the appointment of a lecturer, occasional or otherwise, to give special instruction in the chemistry of colours, as well as other necessary arts.

"The amount of the grant at first, though it may not be required for the remuneration of teachers on the scale of the Institution in its complete state, should be on that scale, as at the outset the outlay upon articles for the Museum will be considerable.

"It should be supplied with a proper collection of books, with casts of the best ornamental works, and a collection of accurate

and well-coloured drawings and prints on botany and zoology.

"The best of our own and foreign manufactured articles should also find a place in the Institution; but their Lordships conceive that with respect to the former, it will not be necessary to incur any considerable expense, as the interest which our manufacturers are likely to feel in the progress of a school which promises to have important influence on their pursuits, will induce them to contribute specimens of their works.

"By these combined means, with the aid of an annual exhibition, and probably of premiums and nominal rewards to successful scholars, their Lordships are of opinion that the experiment will have sufficient trial, and that the ultimate results upon art may safely be left to the operation of those influences which have hitherto governed the progress of all kinds of enterprise in this country.

"I am directed, therefore, in continuance, to request that you will move the Lords Commissioners of his Majesty's Treasury to apply to Parliament for the use of 1500*l.* as a grant for a school of design; and I am also to express their Lordships' hope that apartments may be assigned them in some public building in which the school may be conducted.

(Signed) "DENIS LE MARCHANT."

Copy Treasury Minute, dated July 15.

My Lords concur in opinion upon this subject with the Lords of the Committee of Privy Council for Trade, and will submit an estimate for the grant of 1500*l.* on this account to the House of Commons.

Let an estimate be prepared and laid upon the table of the House of Commons accordingly.

Acquaint Mr. Hume, for the information of the Lords of the Committee of Privy Council for Trade with the directions given, and state that my Lords will hereafter have under their consideration that part of the recommendation which relates to the propriety of providing accommodation for the proposed school in some public building, upon which my Lords can offer no opinion at present.

WEBSTER'S OTAPHONE; OR, PATENT INVENTION FOR ASSISTING THE HEARING.

The inventor was first led to a consideration of this subject by a sensible diminution of the powers of hearing in himself; and observing the general prevalence of this calamity, and also a mode *as generally adopted, of applying the hollow of the hand to the back of the ear to increase the sound*, he was induced to consider, whether the assistance this practice afforded, might not be obtained by means less troublesome and unsightly. With this view, the instrument he has termed an otaphone was first constructed; and its efficiency having exceeded his expectations, and led to the discovery of further benefits resulting from its use, he hopes that a narration of the principles on which it acts, will induce those who are subject to the depressing sensation of partial deafness, to avail themselves of it.

The shape of the outward ear generally escapes observation, but if once the attention is directed to it, it will be found to vary in a greater degree than any other organ; and as it is the outwork to the sense of hearing, the recipient from which all the subsequent changes sound undergoes, proceeds, its figure becomes a matter of important consideration, and it is also deserving of remark, whether it always presented the same external appearance.

On inspection of that splendid collection of statuary, forming the gallery of Egyptian antiquities in the British Museum, it will be seen that, in almost every specimen, the ear is represented to have borne, in that remote age, a larger proportion to the head than at present; while in the Grecian and Roman sculpture, produced, probably, at an interval of 1000 years, it in no instance essentially differs from the most elegant proportions amongst ourselves, except in its greater prominence. The angle formed by the helix, or outer margin of the ear, and the temporal bone, varies in these statues from twenty to thirty degrees; and in the female heads, where it is more delicately constructed, a similar projection is observable.

This difference in its development is the more important, if we consider the very peculiar nature of its structure. Being formed of a substance harder than flesh, which would absorb the sound, and softer than bone, from which it would reverberate; having also such irregularities on its surface as collect the vibrations of air in every direction, and convey them to one general receptacle, it becomes apparent that any diminution of its natural expansion must be greatly prejudicial to the purpose for which it seems so wonderfully constructed; a deduction further confirmed by the fact, that those who possess the most perfect and shell-like form

of ear, have the sense of hearing in the greatest perfection.

This original shape is still preserved by eastern nations; but the climate we inhabit requiring some covering for the head, both by day and night, has greatly tended to alter its form, and certain notions of taste have induced parents to press it to the head as closely as possible.

This organ seems also to have suffered in another respect, having no longer any voluntary power of motion; a faculty possessed by the Arabs and other nations approaching nearest to the primitive state of existence, but which long civilisation has rendered of less importance to us, and time has nearly obliterated. This adaptation of the ears to the direction whence sounds proceed, must greatly increase our auditory perception, and accounts for the wonderful acuteness of hearing possessed by savages. Instances of its existence occasionally occur among ourselves; a most eminent anatomist having favoured the inventor with references to two individuals, who, within the last twelve months, have consulted him, having "a voluntary power over the muscles of the external ear;" and every practitioner of long standing must have witnessed similar cases.

Sir Charles Bell, in the following extract from his work on the "Anatomy and Physiology of the Human Body," thus speaks of it:—"In most men the motion of the ear is lost, but some still retain it; and this is very remarkable,—that when the more internal mechanism of the ear is injured, and ceases to strengthen the sound before it conveys it inwards to the labyrinth, the external ear resumes the office *to which it was originally adapted*, and by a degree of motion and erection assists the hearing."

Having thus established both an alteration in the form, and a loss of power in the use of this important organ, it seemed desirable that the projected instrument should not only accomplish the occasional service at first contemplated, but also attempt some remedy to counteract these permanent disadvantages. For this double purpose the otaphones are now constructed. They are formed from a correct model of the back of the ear, and by fitting all the irregularities of that very *uneven and elastic* surface, gently press *forward the parts* so as to produce a more *perfect orbit*, and *fuller* recipient of sound; and being self supported, they occasion no inconvenience to the wearer. By thus concentrating all the powers that nature has provided, a considerable addition to the ordinary force of sound is obtained; dissipating dulness of hearing, when not arising from internal injury, and enabling those in whom this sense is perfect, to preserve the same advantage at a much greater distance. They will, therefore, be found particularly useful in places of public worship, courts of law, the Houses of Parliament, theatres, and wherever the ordinary powers are insufficient; and by bringing the focus of sound into a more direct line with the face, the expression of the speaker is better preserved than by the unassisted ear.

It is, however, on the advantages they permanently confer, when their use is discontinued, or very rarely resorted to, that the inventor places his greatest reliance for their general adoption. Though obtuseness of hearing arises from many causes, one of the most frequent is the insufficient quantity of sound the external ear collects. When this is the case, the membrane of the tympanum, or drum of the ear, and the internal organs which depend on its vibration for their active employment, become relaxed, and contract the same degree of feebleness as would attach to any other part deprived of its natural action; and this inertness, or stagnation of their powers, renders them unable to surmount those occasional injurious that blows, colds, fever, &c. create; and thus, from the most common accidents, a permanent injury to the sense is induced, which a more active state of the parts would frequently remove. Ear-trumpets, which are generally employed to remedy this defect, often convey a sound painfully acute; and instead of bringing this organ, by gentle changes, to a degree of tension to which it might become equal, they commence with a force, derived from metallic surfaces, which impairs its elasticity, and requires the continuance of the same, or a greater power, to preserve any sensation whatever.

The ear therefore seems to require a degree of exercise proportioned to its capacity, but not exceeding it; and the prevalence of defective hearing leads to the presumption, that a greater nicety is requisite to attain this end, than any artificial means hitherto discovered have

d. The otaphones are based upon nciple, of proportioning their as- e within the limits apparently ed by nature. The alteration they on when worn, is but a restoration ear to its original and most useful ; and for all their subsequent ad- ges, they depend on that peculiar before described, and which is so y adapted to the purpose, that no substance can supply its place. will, therefore, be found equal to rfect restoration of the hearing, if crease of sound, however trifling, eptible on their first application, enerally the use for an hour each ng, for a short time, is sufficient; the impediment has been of long nance, and no advantage on trial erienced, their employment, with- evious preparation, will not be re- ended.

conclusion, it is to be remarked, s the defect these instruments pro- o remedy, arises from insufficient , and not from over exertion, they pplicable at every period of life; those whose hearing is unimpaired, esire to hear as well at a greater ce, will at once perceive the ad- ges they are capable of affording, e louder sound of their own voices.

W.

New Bond-street.

RESOLUTIONS ON RAILWAY BILLS.

e House of Lords having on Wed- y last adopted these resolutions as ip from the House of Commons, ut amendment or alteration, we lose ie in publishing the following au- c copy of them. They will be found very stringent and, on the whole, ry nature :—

ded Standing Orders for next Session.

That when any application is intended nade to the House for leave to bring Bill for making any railway, or for g, extending, or enlarging any rail- lready authorised to be made, or for uing or amending any Act passed for f those purposes, or for alteration of isting tolls, rates, or duties upon any ailway, notices of such intended appli- be given.

That such notices (except as hereinafter *ned) do contain the* names of the *s and townships from, in,* through, and into which any such railway is intended to be made, varied, extended, or enlarged, and if an alteration in any existing tolls, rates, or duties, is intended to be proposed, the intention of proposing such alteration be expressed therein. But in case any such Bill shall be for the purpose only of altering any existing tolls, rates, or duties, or of continuing or amending any former Act, solely for the purpose of tolls, it shall not be necessary to insert in such notices the names of the several parishes and townships.

3. That such notices be inserted three times in the months of August, September, October, and November of this year, or either of them, in some one and the same newspaper of every county in or through which any such railway is intended to be made, or in which such railway, already authorised to be made, is intended to be varied, extended, or enlarged, or if there is no such paper printed therein respectively, then in the newspaper of some county adjoining thereto.

4. That a map or plan and section of the whole of such intended railway, and also of any intended variation, extension, or enlargement of any railway authorised to be made, upon a scale of not less than four inches to a mile, shall be deposited for public inspection at the office of the Clerk of the Peace of every county, riding, or division, in or through which such railway, or such variation, extension, or enlargement, is intended to be made, on or before the 30th day of November next, which map or plan shall describe the line of such intended railway, or of such intended variation, extension, or enlargement, and the lands in or through which the same is intended to be made, together with a book of reference, containing a list of the names of the owners or reputed owners, lessees or reputed lessees and occupiers of such lands respectively; and where such railway or such variation, extension, or enlargement, is intended to pass through any buildings, yards, or court-yards, or land within the curtilage of any building, or through any ground cultivated as gardens, an additional plan of such buildings, yards, land and ground, and of the said railway, shall be laid down upon a scale of not less than a quarter of an inch to every 100 feet.

5. That such section shall be drawn to the same horizontal scale as the plan, and to a vertical scale of not less than one inch to every 100 feet, and shall show the surface of the ground in the line of railway marked on the plan, and shall also have marked on it a line showing the railway line when finished (which line shall correspond with the upper surface of the rails), and a datum horizontal line, which datum line shall be the same throughout the whole length of the railway, and shall be referred to some fixed point

stated on the section. That a vertical measure from such datum line to the line of the railway shall be marked in feet and inches at each change of the gradient or inclination, and that the proportion or rate of inclination between each such change shall also be marked. That the height of the railway over or under the surface of the ground shall be marked in figures at least twice in every mile, and also at every crossing of a turnpike-road, and public carriage road, navigable river, canal, or railway, or junction with a railway, and that it shall be stated on the section whether any and what alteration in the present level of such turnpike-road, carriage-road, river, canal, or railway, is intended to be made. That where tunnelling or arching is intended, the same shall be marked both on the plan and the section.

6. That the clerks of the peace, or their respective deputies, do make a memorial in writing upon the map or plan, section and book of reference so deposited with them, denoting the time at which the same were deposited in their respective offices, and do at all seasonable hours of the day permit any person to view and examine the same, and to make copies or extracts therefrom, such person paying for the same the sum of 1s. for every such inspection, and the further sum of 1s. for every hour during which inspection shall continue after the first hour.

7. That within one calendar month from the time when the map or plan and section shall have been deposited with the clerk of the peace, a copy of so much of the said map or plan and section as relates to each parish, through which any railway is intended to be made, varied, extended, or enlarged, together with a book of reference thereto, shall be deposited with the parish clerk of each such parish in England, the schoolmaster of each such parish in Scotland, and the postmaster of the post-town in or nearest to such parish in Ireland, for the inspection of all persons concerned, at all reasonable hours of the day, such person paying for each inspection the sum of 1s.

8. That within one calendar month from the time when the map or plan and section shall have been deposited with the clerk of the peace, a copy of the said map or plan, section and book of reference, shall be deposited in the Private Bill-office of this House, and that a memorial in writing of the receipt thereof be indorsed by one of the clerks of the said office upon such map or plan, section and book of reference.

9. That before any application is made to the House for a Bill for making any railway, or for varying, extending, or enlarging any railway already made, previous application *in writing be* made to the owners or reputed *owners, lessees* or reputed lessees, by being sent to their usual place of abode in the United Kingdom, or, in their absence, to their agents respectively, and to the occupiers of the lands through which any such railway is intended to be made, varied, extended or enlarged, and that such applications shall be made on or before the 31st day of December next, and that separate lists be made of the names of such owners, lessees, and occupiers, distinguishing which of them upon such application have assented to, or dissented from, such intended railway, or such variation, extension, or enlargement, or are neuter in respect thereof.

10. That before any petition shall be presented to the House for making any railway, or for varying, extending, or enlarging any such railway already made, the lists mentioned in the preceding resolution, and an estimate of the expense, signed by the person making the same, and a copy of the subscription contract after mentioned, be deposited in the Private Bill-office of this House, and that the receipt thereof be acknowledged accordingly by one of the clerks of the said office upon such petition.

11. That before any petition is presented to the House for a Bill for making any railway, a subscription to the amount of one-half at least of the estimated expense shall be entered into by persons under a contract, binding themselves, their heirs, executors, administrators, or assigns, for the payment of the money so subscribed.

12. That no such Bill shall be reported to the House until it has been proved to the satisfaction of the Committee, that three-fourths at least of the proposed capital of the Company has been subscribed under a like contract.

13. That no such Bill shall be reported to the House unless provision be made: 1. That no such Company shall be authorised to raise, by loan or mortgage, a larger sum than one-third of their capital, and that, until 50 per cent. on the whole of the capital shall have been paid up, it shall not be in the power of the Company to raise any money by loan or mortgage. 2. That, where the level of any road shall be altered in making any railway, the ascent of any turnpike-road shall not be more than one foot in thirty feet; and of any other public carriage road not more than one foot in twenty feet; and that a good and sufficient fence, of four feet high at the least, shall be made on each side of every bridge which shall be erected. 3. That no railway, whereon carriages are propelled by steam, shall be made across any turnpike-road or other highway on the level, unless the Committee on the Bill report that such a restriction ought not to be enforced, with the reasons and facts upon which their opinion is founded.

Amended Standing Orders for subsequent Sessions.

No. 1 and 2 same as No. 1 and 2 for *next* Session.

3. That such notices be inserted twice in the month of February, and twice in the month of March, of the year immediately preceding that in which such application is intended to be made, in some one and the same newspaper of every county, in or through which any such railway is intended to be made, or in which such railway, already authorised to be made, is intended to be varied, extended, or enlarged, or if there is no such paper printed therein respectively, then in the newspaper of some county adjoining thereto. But in case any such Bill shall be for the purpose only of altering any existing tolls, rates, or duties, or of continuing or amending any former Act, such notices shall be inserted three times in the months of August, September, October, and November, or either of them, immediately preceding the Session of Parliament in which such application is intended to be made, in some one and the same newspaper of every county in or through which any such railway is authorised to be made; or if there is no such paper printed therein, then in the newspaper of some county adjoining thereto.

4. Same as No. 4 for next Session, except that the plan must be deposited " on or before the 1st day of March, in the year immediately preceding that in which such application is intended to be made."

5. Same as No. 5 for next Session.

6. That parties desiring to make any alteration in the line of any railway, the plans for which shall have been deposited, and the notices for which shall have been given as before-mentioned, shall be permitted so to do, provided no one deviation shall exceed one mile in length, and provided a plan and section of such alteration, together with a book of reference thereto, shall be deposited with the clerk of the peace, and a plan and section so far as relates to each parish, together with a book of reference thereto, with the parish clerks of the several parishes in which such alteration is intended to be made, on or before the 30th day of November, in the year immediately preceding that in which such application is intended to be made, and that the intention to make such alteration shall be advertised in manner before directed, twice in the month of September, twice in the month of October, and twice in the month of November, and that personal application shall be made to the owners or reputed owners, lessees or reputed lessees, or in their absence from the United Kingdom to their agents respectively, and to the occupiers of lands through which any such alteration is proposed to be made.

7. That parties desiring to make an application for a Bill to vary, extend or enlarge, any line of railway, for making which an Act of Parliament shall have been passed, shall be permitted so to do, provided that no one deviation shall exceed one mile in length, and provided a plan and section of such variation, extension, or enlargement, together with a book of reference thereto, shall be deposited with the clerk of the peace; and a plan and section, so far as relates to each parish, together with a book of reference thereto, with the parish clerks of the several parishes in which such variation, extension, or enlargement, is intended to be made, on or before the 30th day of November, in the year immediately preceding that in which such application is intended to be made, and that the intention to make the application for such variation, extension, or enlargement, shall be advertised in manner next before directed, in September, October, and November; and that personal application shall be made to the owners or reputed owners, lessees or reputed lessees, or, in their absence from the United Kingdom, to their agents respectively, and to the occupiers of the lands through which any such variation, extension, or enlargement, is proposed to be made.

8. That parties desiring to renew (in the then next ensuing Session) any application to Parliament in respect of any railway, the plans for which shall have been deposited, and the notices for which shall have been given, as before directed, shall be permitted so to do, provided that no one deviation shall exceed one mile in length, and provided a plan and section of such railway, together with a book of reference thereto, shall be deposited with the clerk of the peace; and a plan and section, so far as relates to each parish, together with a book of reference thereto, with the parish clerks of the several parishes through which such railway is proposed to be made, on or before the 30th day of November, in the year immediately preceding that in which such application is intended to be made, and that the intention to make such application shall be advertised in manner next before directed, in September, October, and November; and that personal application shall be made to the owners or reputed owners, lessees or reputed lessees, or, in their absence from the United Kingdom, to their agents respectively, and to the occupiers of the lands through which any such railway is proposed to be made.

Nos. 9, 10, 11, 12, 13, 14, 15, and 16, same as Nos. 6, 7, 8, 9, 10, 11, 12, and 13, of standing orders for next Session.

13. That before any petition shall be presented to the House for making any railway, or for varying, extending, or enlarging any such railway already made, the lists mentioned in the preceding Resolution, and an estimate of the expense, signed by the person

making the same, and a copy of the subscription-contract after-mentioned, together with a statement of any alterations from the book of reference which may have arisen since the same was deposited, be lodged in the Private Bill-office of this House, and that the receipt thereof be acknowledged accordingly by one of the clerks of the said office upon such petition.

14. That before any petition is presented to the House for a Bill for making any railway, a subscription to the amount of one-half at least of the estimated expense shall be entered into by persons under a contract, binding themselves, their heirs, executors, administrators or assigns, for the payment of the money so subscribed.

15. That no such Bill shall be reported to the House until it has been proved to the satisfaction of the Committee, that three-fourths at least of the proposed capital of the Company has been subscribed under a like contract.

16. That no such Bill shall be reported to the House unless provision be made:—1. That no such Company shall be authorised to raise, by loan or mortgage, a larger sum than one-third of their capital; and that, until 50 per cent. on the whole of the capital shall have been paid up, it shall not be in the power of the Company to raise any money by loan or mortgage. 2. That, where the level of any road shall be altered in making any railway, the ascent of any turnpike-road shall not be more than 1 foot in 30 feet, and of any other public carriage-road not more than 1 foot in 20 feet; and that a good and sufficient fence, of 4 feet high at the least, shall be made on each side of every bridge which shall be erected. 3. That no railway whereon carriages are propelled by steam shall be made across any turnpike-road or other highway on the level, unless the Committee on the Bill report that such a restriction ought not to be enforced, with the reasons and facts upon which their opinion is founded.

Special Resolution, applicable to all future Sessions.

That no line of railway shall be deemed a competing line in contemplation, unless the plan and section for the same shall have been deposited, as required by the standing orders, on or before the 1st day of March in the year 1837, or on or before the 1st day of March in any succeeding year.

NOTES AND NOTICES.

Belgian Railway.—An account has been published of the original cost, expense of maintenance, and revenue, of the railway from Brussels to Antwerp, with the general results of the undertaking, forming, on the whole, a document of some interest to railway projectors and speculators. The line from Brussels to Mechlin was opened in May, 1835, and that to Antwerp, which completes the undertaking, on the 1st of May of the present year. The cost of the whole line, including the purchase of land, with locomotive engines and carriages, was, in round numbers, 179,000*l*. The expense on the line to Mechlin, for the first year, was 7,350*l*. The sum received was 14,376*l*., and the clear profit, after charging 5 per cent. as interest on the capital, was 3½ per cent. The number of passengers during the first year, 563,000. During the month of May last, when the whole line was open, the number of passengers was 101,000, and the sum received was 4,313*l*. According to an estimate prepared of the charges and income from May, 1836, to May, 1837, a profit of 11 per cent. was anticipated on the invested capital, in addition to the ordinary interest of 5 per cent. The average duration of the passage from Brussels to Mechlin, 13 miles, is from 30 to 35 minutes, including stoppages; that from Brussels to Antwerp, 27 miles, is from 1 hour 25 minutes to 1 hour 45 minutes, including stoppages. The speed originally calculated was two hours. The fare in the coaches is 3*s*.; in the waggons, 1*s*. Before the opening of the railway from 15 to 20 diligences ran between Brussels and Antwerp, carrying a yearly average of 80,000 passengers, at 2*s*. 6*d*. to 4*s*. each. These have entirely ceased to run, as well as the canal-boats, except a few for the conveyance of goods, for which the railway has not yet been employed.

Phrenology.—The Academie de Medecine has been called upon to decide the important question of phrenology. The discussion occupied four sittings. Dr. Broussais, who is at the head of the phrenological school, maintained the principles which he had laid down in his lectures. M. Gueneau de Mussy had to sum up the arguments on both sides, and in conclusion gave an opinion that the system ought not at present to be adopted. The Academy, concurring in this opinion, deferred its decision till the system was established upon more solid bases.—*Paris Journal.*

Errata in the Description of Mr. Pickworth's Paddle-Wheels.—P. 322, col. 1, lines 5 and 6:—The "transverse bars" here mentioned do not exist in the drawing, but instead thereof there is a pintle on one side of the revolving-frame and a crank on the other.—Col. 2, line 5 from the top, for "to" read "that the broader part of the paddle shall".

P. 323, col. 1, lines 1 and 2 from top, for the words, "when revolving as well as when fixed; both have," read "both revolving and fixed; each has".

P. 325, col. 1, line 27 from bottom, the word "time" should end the paragraph.—Dele "And"; the word "when" begins the new paragraph.—Line 24 from bottom, for "Nearly" read "but"; and for "may be" read "are".

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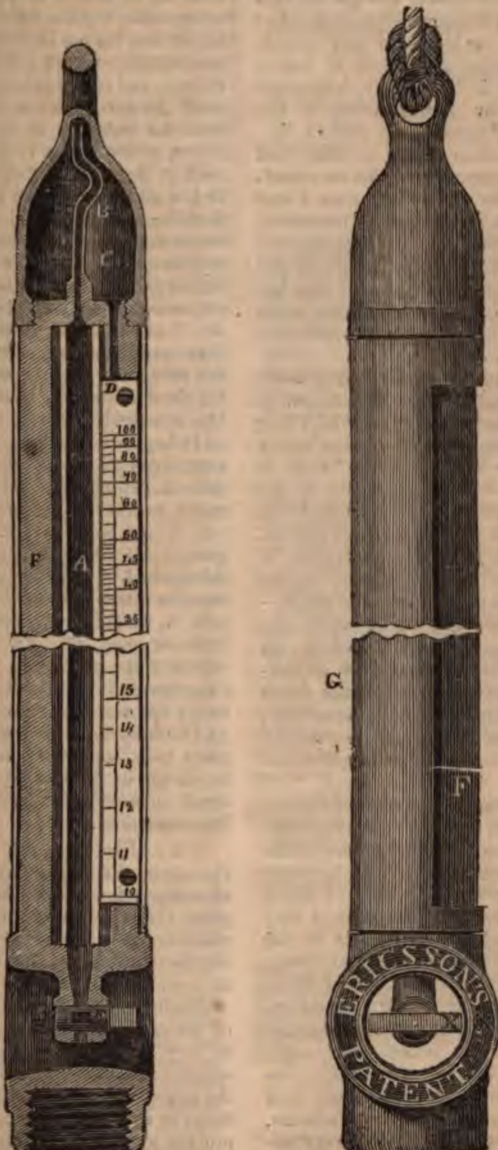
ERICSSON'S PATENT LEAD, OR SOUNDING-INSTRUMENT.



ERICSSON'S PATENT LEAD, OR SOUNDING-INSTRUMENT.

This instrument may be considered as an important addition to the valuable discoveries which have been made in modern times to render navigation safe and easy; its principle being such, that it enables the navigator to take soundings, or ascertain the depth of water, whilst the ship is under way, and independently of the measurement of the lead line.

The inconvenience, loss of time, and frequently danger, consequent on rounding a ship to the wind every time a cast of the deep-sea lead becomes necessary, is best understood by the experienced sailor; and he can best judge of the utility of a sounding-instrument who has seen the safety of a numerous crew and a fine ship depend entirely on the accuracy of the soundings.

All persons employed in laying down deep soundings, in the construction of charts, know the ordinary way of doing it to be a laborious and unsatisfactory operation; for although the ship is rounded to the wind at every cast of the deep-sea lead, still, as the line which the lead takes down with it considerably retards its descent, the ship drifts over it, and by the time the lead has got to the bottom the line is no longer up and down—which is the sole condition on which the depth is measured—and therefore an arbitrary allowance, depending on circumstances, must be made on the depth shown, which causes all deep soundings, unless taken under the most favourable circumstances, to be liable to great uncertainty.

In order to remedy this great defect in navigation, many persons have suggested contrivances by which the *pressure* of the water might be made available in ascertaining the depth. The idea of using compressed air for this purpose is of very remote date, but the difficulties in the way of applying it to practice have been, first, the establishment of a register which could be depended on to certainty to remain at the same point after the pressure that advanced it was taken away—and, secondly, the graduation of the scale; because the air being compressed into half its bulk at a depth of only 5½ fathoms, *the graduations must diminish very rapidly. These difficulties* have been over*come by the invention* we are about to describe, in a manner peculiarly simple, and altogether precluding the possibility of error in the indication.

A (see front page) is a glass tube open at both ends, firmly bedded in the cast-iron stem F, by means of plaster of Paris or other cement. B is a small tortuous pipe inserted into the top of the glass tube, and in continuation with it; this pipe is open at the top, and communicates therefore freely with the air-chamber C; and this last, with the external air by the small tube, whose orifice is D; E is a common stop-cock at the bottom of the glass tube; and G is a slide, or guard to the glass tube and the graduated scale of fathoms. The lower end can be loaded with lead when required, and takes the arming as usual. When the instrument is to be used, the stop-cock E is closed, by setting it at X, fig. 2, after turning it to let out any water that may have been suffered to remain in the tube; the guard is drawn round, and the lead is thrown overboard, with the line attached. The pressure of the water at D begins at once to exceed the pressure of the air within the chamber C and tube A, which of course was that indicated by the barometer before the lead was thrown overboard, and the water begins to rise through the small tube D into the chamber, driving the air before it into the upper portion of the chamber and tube A, until it has risen to the top of the tortuous pipe B. At this instant the whole of the air before contained in the chamber and tube is confined in the tube only; the water, therefore, still entering at D, falls over the orifice of B into the glass tube, and rises in it; the division to which it rises always indicating the depth to which the lead at that instant has descended.

It is evident from this description, that the air in the tube being in a high state of compression before the graduation begins, the divisions of the scale are more uniform, and therefore indicate greater depths with more accuracy than if the tube alone contained all the air.

Again, the register, being the column of water in the tube, cannot be affected by any shock, nor disturbed, unless the whole be held for a second or two with the upper end downwards, which the tortuous or cork-screw tube B is intended to provide against; and, lastly, the pressure of the air within being always exactly equal to that of the water without, there

is no strain upon any part of the instrument, except the effort every where to crush the solid material, which probably would not take place even if the force were infinite, because there is the greater probability that the water would first penetrate the pores, and thereby preserve the equilibrium.

As the lead is hauled up again, the air expanding in the tube, forces the water gradually out of the chamber, and it rises till it arrives at the surface. When it is taken on board, being always held nearly upright, though not necessarily quite so, the guard is drawn back, the soundings read off, and then the arming examined. The water then being let out by the cock, it is set again at X, and the instrument is ready for use.

The divisions on the scale are made not by calculation or any theoretical process, but by actually subjecting each instrument to hydraulic pressure in an apparatus constructed by the inventor for that purpose, and by which a pressure equal to that of the water in the sea, at any given depth, is denoted with great accuracy.

This instrument being capable of measuring very great depths, we understand it is about being employed for the purpose of determining the depth of the ocean, a problem of great interest. On this ground, and in order to form a correct notion of the effects of the temperature of the water on the indications of the scale, on ordinary occasions of sounding, the following investigation of the properties of this instrument (extracted from the *Nautical Magazine* for July last) cannot fail to interest the mechanical world :—

" Since at any depth, in consequence of the free communication, the pressure without (p) is in equilibrium with the elastic force within (f), we have the equation $p=f$, both pressures being referred to in the unit of surface.*

" Let a be the depth of the machine in a state of rest, ρ the density of water, β the height of the water-barometer. Also, the elastic force being directly as the whole quantity of air, or solid content (S) of the chamber and tube, and inversely as the space occupied by the air in the instrument, in the part that is free from water, will be equal to $\frac{s}{S}$ multiplied by some constant A; hence the first equation becomes

$$(a+\beta)\rho = A\frac{s}{S}$$

To determine A; when the instrument is at the surface, $a=o$, and then S and s are identical;

$$\text{hence } A = \beta\rho, \text{ hence}$$

$$a+\beta = \beta\frac{s}{S}$$

" Now, S is the reservoir or chamber C, *plus* the glass tube, whose length denote by l, and area by πr^2, neglecting the small tube at D, and the substance of the tortuous tube B, as insensible, and s is that part only of the glass tube which is free from the water, standing at the height h, plus the small tortuous tube B, whose content is $t\pi r'^2$, or $s = (l-h)\pi r^2 + t\pi r'^2$, hence

$$a+\beta = \beta\frac{\left((l-h)r^2 + t r'^2\right)\pi}{C + l\pi r^2}$$

which is the equation connecting the depth, dimensions of the instrument, and height of the barometer, exclusively of considerations of temperature, in which $t r'^2\pi$ may be neglected.

" Taking for granted, to begin with, that the water is colder than the air, the quantity of air actually compressed into the space s is not S, but is S diminished by a quantity due to its condensation by cold. Let $\theta =$ the temperature of the air, θ' that of the water at the depth a, in degrees of Fahrenheit, and α the fraction which a given mass of air expands by the addition of 1° of heat ($\alpha = \frac{1}{480}$ nearly); then S′ being the content, or mass of air, as affected by temperature,

$$S' = S - \alpha(\theta-\theta')S = \left((1-\alpha(\theta-\theta')\right)S.$$

Hence, by reduction, we get

$$h = l - \beta\frac{\left(1-\alpha(\theta-\theta')\right)S}{(a+\beta)\pi r^2}$$

Now $(a+\beta)\pi r^2$ is a column whose base is the area of the glass tube, and height the depth of the instrument under water *plus* the height of the water-barometer, let $c =$ such a column; then

$$h = l - \beta\left(1-\alpha(\theta-\theta')\right)\frac{S}{c}$$

If there be no difference of temperatures, let h_0 be the height in the tube, then $h_0 = l - \beta\frac{S}{c}$; since $\theta-\theta'$ cannot exceed 130°— 32° or 98°, $1-\alpha\,(\theta-\theta')$ is always less

* " Captain Ericsson has *constructed* another form *of this instrument, in which the equilibrium is established between the weight of a column of quicksilver and the elastic force* of nitrogen gas, *but it is the same in principle* as that here discussed *by Lieut. Raper.—Ed. N. M.*"

than 1; hence $\left(1-\alpha\,(\theta-\theta')\right)$ is always positive, and $\beta\left(1-\alpha\,(\theta-\theta')\right)\frac{s}{c}$ is less than $\beta\,\frac{s}{c}$; hence $h > h_0$, or, the water will always stand *higher* in the tube than if no such difference of temperature existed.

"Subtract h_0 from h, then $h-h_0=\alpha\,(\theta-\theta')\,\beta\,\frac{s}{c}=\alpha\,(\theta-\theta')\,\beta\,\frac{s}{c}$ nearly, as β is small to great depths; that is, the error of the scale caused by the difference of temperature is as the height of the barometer, and inversely as the depth; hence, as the depth increases it becomes of less consequence.

"To find at what depth, with a given instrument, the graduation will begin, making $h=0$, and supposing $\theta=\theta'$ nearly

$0=l-\beta\,\frac{s}{c}$ nearly; whence α is found."

Respecting the variation in the indications produced by difference of temperature, let us suppose one instrument had been graduated in water at 40°, while the air was 80°, and the other in water and air of equal temperatures—what is the difference of soundings shown by the two?

"Let $h_{,}$ be the height of the column of water in the tube of the first, then $h_{,}=l-(1-\frac{1}{480}(80°-40°)\,\beta\,\frac{s}{c}$; or, $h_{,}=l-\frac{23}{24}\,\beta\,\frac{s}{c}$. Hence $h_{,}-h_0=\frac{1}{24}\,\beta\,\frac{s}{c}$; now, since the water fills every part of the instrument, except the upper portion of the glass tube, whose length is l, it follows that $\beta\,\frac{s}{c}$ is the upper, or unoccupied part of the tube; hence the difference of the soundings of the two instruments is $\frac{1}{24}$ of the length of the tube above the water, which corresponds in the 100-fathom lead to about *one fathom* in all cases. This is a very curious result, and is quite satisfactory as to the performance of the instrument as regards temperature."

By some experiments made by Captain Ericsson, it appears that water loses $\frac{1}{1000}$ of its bulk in 100 fathoms' depth. This will be quite insensible on common occasions; but for scientific purposes a correction may be applicable.

PICKWORTH'S PADDLE-WHEEL.

Sir,—I am flattered by the favourable *manner in* which you have been pleased to notice my paddle-wheel generally, and perceive the force of your objection respecting weight, but this is true only when the *fixed frames* are attached to the wheel, which are not necessary: and without them my wheel is as light as any improved paddle-wheel, and lighter than most.

An advantage would certainly be gained by adopting your suggestion of rods instead of plates for the vertical paddle-frame bars, in the circumstances to which you refer; but in their present form they prevent the lateral escape of water from the paddles when propelling.

Your engraver has, by mistake, carried his water-line of fig. 2 to the wheels B and C, which are withinside of the vessel.

I am, Sir,

Your obedient servant,

H. Pickworth.

1, Lincoln's Inn New-square,
Aug. 15, 1836.

LONDON AND BIRMINGHAM RAILWAY.

Report of the Directors to the Sixth Half-Yearly General Meeting of the Proprietors, held August 5, 1836.

The Directors have the satisfaction to announce to the Proprietors, that the progress of the works generally, in the last six months, has been such as to warrant the expectation which was held out at the last meeting, that the whole line will be completed by the summer of 1838, and the first 21 miles from London in the spring of 1837.

Of the Primrose Hill Tunnel, which is 1105 yards long, only 114 yards remain to be made; the Kensal Green Tunnel is finished, and traversed by the Company's locomotive-engines; 1423 yards are completed of the Watford Tunnel, the total length of which is 1793 yards; and the difficulties which were presented by the quicksand in the Kilsby Tunnel have already been so far surmounted, as to leave no doubt in the mind of the Company's engineer, that they will not delay the opening of the railway beyond the time mentioned. With reference to the other portions of the work, the Directors are making every exertion to forward them, so as to give the Proprietors the benefit of a revenue at the earliest possible period; satisfied that although for the attainment of this object an additional charge will be incurred by the Company, the advantage to be derived from it will be more than commensurate to the expense.

The Directors have entered into a contract, under the guarantee of two responsible sureties, with Mr. Edward Bury, of Liverpool, a

able and experienced builder of locomotive-engines, for the conveyance of passengers and goods, on the railway, by locomotive-power, to whatever extent may be required, at a fixed rate of remuneration; the Company providing engines of Mr. Bury's specification, and Mr. Bury, on his part, maintaining and keeping them in repair; the contract to be in force for three years from the opening of the railway. The Company have thus assured to themselves the advantage of locomotive-power at a uniform and moderate rate, and under a system of management which it is the interest of the contractor to render mutually beneficial to the Company and himself. The Directors have also contracted for such locomotive-engines as will be first wanted, and for a portion of the carriages.

The Directors in referring to the Bills for railways, connected with the London and Birmingham, which have received the Royal Assent in the present Session, feel themselves called upon to congratulate the Proprietors on the great accession of traffic which they may anticipate from the direct communication opened with the northern and eastern parts of the kingdom, by means of the Midland Counties, North Midland, and Birmingham and Derby Railways, not to mention the connexion between Birmingham and Gloucester, by the Birmingham and Gloucester Railway, nor minor lines, which will all contribute to swell the revenue of the Company. Acting upon the suggestion of the Proprietors at the last General Meeting, and considering it desirable that a connexion should be secured with Leamington and Warwick, the Directors have instructed the Company's engineer to ascertain the levels for a branch-line to those places, to join the London and Birmingham Railway near Coventry; and they have also set on foot the usual investigation into the traffic, so as to be prepared to follow up the object with such measures as may, in the opinion of the Proprietors, be deemed expedient.

By the statement of accounts now to be laid before the Proprietors, it will appear that

	£.	s.	d.
The receipts to the 30th June were.............	1,955,608	0	5
The disbursements........	1,492,100	16	8
That the balance in favour of the Company was, at that date..............	463,507	3	9

And that the amount received on loan, pursuant to the powers given by the last General Meeting, was 443,800*l.*

It is estimated that the liabilities of the Company, for the next six months, will be sufficiently met by the cash at their disposal, and by loans which have been tendered and agreed for, with the addition of calls. Great as the present scale of expenditure will appear, the Directors are satisfied that so long as the works proceed with energy proportioned to that expense, the Proprietors will hail the increase as an additional evidence of the approach of their great undertaking to completion.

SUBSTITUTE FOR LIGHTHOUSES ON THE SHORES OF THE BLACK SEA.

Translation of a Note addressed to the British and other Foreign Ambassadors at Constantinople, in December, 1829. By Colonel MACERONI.

From the highest antiquity, the Black Sea has had the melancholy celebrity of being the most dangerous of all those which have been, or are at present, frequented by navigators! Thus it was named by the Romans, "AXENUS" *sive inhospitalis.* The nature and the direction of the winds which predominate—the formation of its coasts and shallows—of its very ports and its atmosphere—present innumerable dangers, even in summer; in the winter these perils are augmented a hundred-fold! Since the 1st of last November, no less than eleven out of twenty-three vessels, which have sailed between this port and Odessa, have been miserably lost!

By the aid of lighthouses placed on dangerous places, or at the entrances of harbours, the navigation of ships in the vicinity of shores is greatly aided during the darkness of the night. But unless such lights be sufficiently refulgent and *elevated*, and unless the atmosphere be sufficiently clear to permit of the lights *being seen at a sufficient distance*, it often happens that the unhappy sailor does not discover them in time to avoid the dangers which they indicate, or to enter the harbour of which they announce the entrance!

The dangers of the Black Sea are greatly enhanced, and indeed mainly consist, in the dense and sudden fogs which cover its surface. It would be very easy to account for the formation of these fogs by referring to the currents of cold air, which, suddenly rushing from the north-east, meet the warm and moist atmosphere confined within the mountainous margins of the Black Sea. But this disquisition is not to my purpose, because no remedy can be offered for an exhibition of the laws of nature depending on geographical features of locality. The fact is, that whenever a north wind

blows, especially in the autumn and in winter, the Black Sea is covered with an almost impenetrable mist. The course of a vessel steering from Odessa to Constantinople is from north to south. If a strong wind prevails, and the mouth of the Bosphorus be missed, owing to mist or darkness, the rounding of the southern coast causes the unhappy vessel to find itself almost immediately with a lee-shore a-head, upon which it rarely escapes being driven and totally lost!

It is absolutely necessary that the entrance of the Bosphorus should be recognised *at a very considerable distance*, because if it is overshot, with a strong north wind blowing. perdition is sure to follow. The amount of lives and of property annually lost in this way is truly appalling! Twenty-seven vessels, and their crews, have thus perished since I have resided in this capital! It seems that, when in a gale of wind from the north (always accompanied by a mist) if the entrance of the Bosphorus be once overshot, there is no further hope. The low, shelving southern coasts of the Black Sea offer no other refuge, or none can be discerned.

To the evils above sketched out I propose to apply a palliative. Lighthouses are admirable constructions; but they are expensive, and require time to erect. Moreover, on a low coast it is not easy to give them that degree of elevation which will ensure their being descried at a sufficient distance. Besides which, the case is urgent, and a remedy is called for *at this very moment*, while we daily and hourly receive the afflicting accounts of loss of life and property to an enormous amount.

The expedient which I propose is the use of rockets, projected vertically in the air during a storm, from such points as it is essential to designate to the bewildered navigator. A 6-pounder rocket, properly made, will rise above 1000 yards perpendicularly in the air. At that elevation the head or pot is made to burst, and about half a pound of combustible composition, of a most refulgent brightness, is detached from the rocket, and burns suspended in the air for about one minute. This light is far more intense than any of the lamps of the best lighthouses; and its very superior elevation (being *thirty times higher*) causes it to be perceived at a much greater distance. Moreover, its sudden appearance, and the manner of its combustion, can never allow of its being mistaken for some fire on a mountain; and the same suddenness strikes more attention than any fixed light whatever. By means of a little parachute, invented by Sir W. Congreve, the cage containing the refulgent light is suspended in the air so as to fall a very few yards during the period of its combustion. I have discovered a composition which gives much more light than any hitherto used.*

Depôts of such rockets should be formed at the necessary points, only to be sent up on the occasion of a storm by night. One may be fired every five or ten minutes; and as the number of stormy nights in the year does not average more than thirty, and that not during the whole night, the consumption of rockets would not be an expense of national importance. When rockets are projected from more points than one, the locality may be indicated by a difference in the colour of the light. Some may give a red, a green, a white, or a blue light. To cover the expense, a small tax or toll might be exacted from all vessels navigating the Bosphorus and the Black Sea; which I suppose they, or their respective Governments, would gladly submit to, in consideration of the great advantage received. I am ready to give directions and exhibit experiments, to prove the merits of my plan, quite gratuitously.

(Signed) MACERONI.

ELECTRICAL THEORY OF THE UNIVERSE.

Sir,—Your correspondent Kinclaven labours under a mistake with regard to the "Electrical Theory of the Universe." It is no where stated to be in accordance with the laws of Kepler, nor, indeed, with any other; it would have been quite premature to have made such a statement. If he will examine it more attentively, he will perceive, that so far from the momentum of the planets being extinguished, they are supposed to be accelerated, because it is assumed that they move in spiral orbits, which (the orbits being elliptic) is the same in effect as if they were rolled down an undulatory inclined plane. This assumption derives support

* His Excellency General Count Guilleminot, the French Ambassador here, has seen me set fire to and consume a cypress tree with one of my compound naval rockets, at 1000 yards distance, horizontal range.

from several considerations, as well as from the established fact of the moon's secular acceleration. Kinclaven says, hundreds of reasons might be urged against the electrical theory. This was to be expected; it is in the nature of things that it should be so. The plainest truths in science have been at one time or other opposed by hundreds of objectors: indeed, some weighty objections have been urged against the theory of universal gravitation, which, it appears, have not yet been answered in a manner to satisfy the objectors. The whole doctrine may be said to rest upon the following propositions:—1st. That a body in motion will continue to move uniformly forward in right line, if not disturbed by the action of some external cause. 2nd. That there is no external resistance, that is, that the planets move *in vacuo*. 3rd. That by the sun's attraction (*acting against the momentum*), the planet is held or drawn back, and retained in her orbit. Now will this bear a close examination, that the momentum of a body, a quantity subject to diminution and utter extinction, shall remain for ever the same with a constant unalterable force acting against it; by the momentum or diminishable quantity the moving body continually endeavours to fly off from the centre, and by the action of gravity, an undiminishable quantity, the moving body is continually drawn back towards the centre, and yet the momentum, with a constant force acting against it, remains, and is to remain undiminished to the end of time. This is past all human comprehension. Sir Isaac Newton seems to have felt the force of this objection, and a few others, which were urged during his lifetime; in answer to which he put forth the following definition:—"Attraction is an indefinite principle, not implying a particular manner nor physical cause of action, but only a tendency of approaching; whether it proceed from any external cause, or be inherent in bodies themselves, excluding the idea of impulse from its consideration."

Whoever allows himself to reflect upon the above definition, will probably become cautious and circumspect, and less dogmatical in his manner of asserting the "unerring laws of universal gravitation."

I remain, Sir, yours obediently,

T. S. MACKINTOSH.

ELECTRICAL THEORY OF THE UNIVERSE. —URSA MAJOR'S REPLY TO KINCLAVEN.

Sir,—Kinclaven seems to think that discretion is the better part of valour. He was requested to explain the paradox of the tides, but seeing that it might be rather difficult to maintain the position which it would be necessary to take, he shifts his position, and, in answer to Ursa Major, opens an attack upon a point which Ursa Major has no inclination to defend. However, I suppose we shall be enabled to dispense with Kinclaven's demonstration, as I perceive another correspondent has taken the field armed with a machine, by the help of which he proposes to give "ocular demonstration," that the double diurnal tide is in perfect accordance with the theory of universal gravitation. I congratulate Kinclaven upon the very efficient assistance that he is likely to receive from this able auxiliary with his *new theory of the tides*, which is about 200 years old. Before Mr. Clarke commences operation with the machine, it might be worth his while to consider more attentively the nature of the demonstrations that are likely to result from its action. What would the machine demonstrate? Simply this; that one tide is an effect of gravitation, and the other an effect not of gravitation, but of *motion*, produced by the earth revolving upon an eccentric axis. The absurdities to which this supposition would lead, are, if possible, worse than those that are intended to be removed. Mr. Clarke places the common centre of gravity of the earth and moon somewhere about 200 miles *beneath* the surface of the former, whilst Dr. Wilkinson finds that it is 2000 miles *above* the surface; but I suppose a thousand miles or two one way or other makes very little difference.

I beg to thank Kinclaven for his advice, with regard to Professor Airy's work, and to assure him that I am sufficiently read in mathematical science to discern that where there are half a dozen different demonstrations contradicting each other, they cannot be all true. I have subjoined an extract from Dr. Wilkinson, which appears to me to set the matter in dispute in a fair point of view.

I remain, Sir, yours, &c.

URSA MAJOR.

"Kepler, who first suggested the influence of a gravitating principle in nature, with

respect to the cause of the tides, entertained an extravagant supposition of the earth being a living animal, and the flux and reflux of the sea the results of the action of respiration. Galileo supposed tides to be produced by the different velocities of the annual and diurnal motions of the earth; if so, the tides should occur at the same periods, without variation in their rise; but they are observed to move through the twenty-four hours, and vary daily in their elevation. The illustrious Newton, in his Principia, has stated his opinion that there is an attractive power existing between all bodies in proportion to their quantity of matter, and the inverse duplicate ratio of their distance, and hence has reduced to geometrical demonstration the varied influence of the moon as she moves in her orbit, how the tides are governed by her nearest and most remote distance from the earth, the changes observed from the different inclinations of her orbit to the ecliptic, and from the irregular motion of her nodes. Whether such a force or power be hypothetical or real, I presume that the geometrical demonstration will not be affected. *If gravitation be not admitted as a principle competent to explain the phenomena, we must substitute some other agent capable of producing all the effects observed.*

"Supposing the mean distance of the moon from the earth to be sixty times the radius of the earth, and if the law of gravitation be assumed, according to Newton, as diminishing as the square of the distance increases, it will be evident that sixty multiplied by sixty, being equal to 3600, will express this proportion, viz. that 3600 lbs. on the surface of the earth, removed to the moon's surface, would only weigh one pound. As the waters of the ocean are the only part of our planet susceptible of any change from such an influence, the tendency of the waters of the ocean towards the centre of the earth will be in the same proportion diminished. Let us suppose the gravitating powers of the waters of the ocean, when under the direct influence of the moon, to be diminished in this proportion, viz. one-sixteen hundredth part. From the law of pressure, with respect to liquids, the action is equal in every direction, and which action is attributed by Newton to the power of gravitation being uniform; if this power be disturbed in any part, there will be a determination of water to that part, till the equilibrium be restored; and the elevation of waters in that part will constitute the tide. Let us suppose the mean depth of the ocean four miles, thus one-sixteen hundredth part of this being elevated *will be about six feet.* Newton does not confine the diminution of gravitation in the water of the ocean merely to the influence of that luminary; he supposes a co-operation of the sun, which he concludes, from its quantity of matter compensating for its greater distance, produces an effect about one-third of that of the moon; so that when combined, as in new moon, their united effects would under such circumstances produce an elevation of eight feet. When the moon is in her quadratures, i. e. when she appears to us as a half moon, then they counteract each other, and the tide will be proportionate to the difference, viz. by the above supposition, four feet, constituting what is denominated Neap Tides.

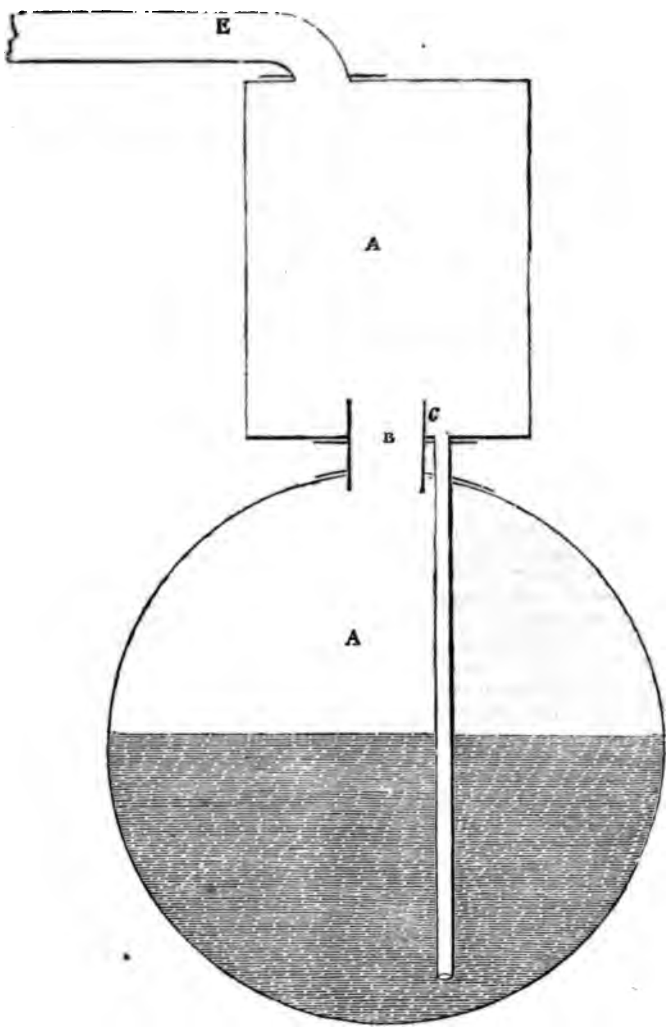
"These admeasurements are only assumed for the purpose of illustration. It is well known that at the same period there is a spring tide at new moon, at the Nadir, as well as at the Zenith, part of the earth; this presents the greatest difficulty to the Newtonian theory. If, according to the Newtonian hypothesis, an elevation of those waters, which are in a direct line with the moon at or near her meridian, is to be referred to the cause afore mentioned, the same hypothesis is extended to account for the tides on the opposite side of the globe, to the earth itself being attracted from the waters situated at the Nadir. If we consider the elevation of the waters on each side of the globe to be eight feet, it is evident that the earth must, by the attractive power of the luminaries, have been removed sixteen feet. However incomprehensible this theory is, the difficulties are increased by the application of the same principle to the explanation of spring tides at full moon, when the earth is placed exactly in a line between the two luminaries.

"In the year 1779, I published an '*Analysis of a Course of Lecture.*' I therein attempted to explain the phenomena of the tides, on the principle of the motion of the earth round the centre of gravity of the earth and moon. A similar explanation had been surmised by the learned Dr. Wallis in 1666. I am not aware that he attempted any demonstrations of such an opinion. In the different courses of lectures I have delivered during a period of near thirty years, when upon the subject connected with the tides, I have invariably attributed them to the result of this motion. The earth does not move in a regular elliptic orbit round the sun, but describes a series of volutes round the centre of gravity between the earth and the moon. As the density of the moon is to the density of the earth as 11 to 9, which has been deduced from calculations of the space the moon falls below the tangent of her orbit in a given time; as the diameter of the moon is 2161 miles, therefore is in proportion to the mass of earth as 1 to 49·22, from these data it is evident that the distance of the moon's centre from the common centre of gravity of the earth and moon is as 39·788 to 1, or 5880 miles from the centre of the earth.

"It will hence appear that the earth has

a triplicate motion—one round her axis, constituting day and night; one round the sun, constituting the year; and a motion in common with the moon round the centre of gravity."

STEAM-BOILER EXPLOSIONS.



Sir,—I have read with some interest the American experiments on steam-boiler explosions, concluded in your last month's *Number*. There yet remains *much to be done on the subject, and I am surprised that a matter of such immense importance to this country should* have so long remained unsifted by competent persons.

After the last explosion at Glasgow, a degree of anxiety and excitement prevailed as to the cause, and a reward of 100*l*., and various smaller prizes, were offered by the magistrates at Glasgow f

the best and next best suggestions as to the cause and method of preventing the recurrence of steam-boiler explosions. It was understood, that no fewer than seventy-four plans, suggestions, essays, and lectures were handed in, but the matter has not gone farther, at least the plans have not been made public, which is much to be regretted, for from among the mass of useless matter which would be produced, surely something towards effecting a cure would have come out.

My object in noticing this subject is to offer some remarks on the subject of "foaming," known by the name of "priming" in this country. As far as I can see, the Committee of the Franklin Institute have elicited *nothing* as to the cause of this phenomenon, nor given any cure for it. They notice a very feasible plan by Mr. Ewbank (the perforated steam-pipe), but they do not tell if it prevents the foaming. Every person conversant with high-pressure engines knew perfectly without looking in at a window that a foaming commenced when the engine began to work, and that the gage-cocks at that time would blow water, although the floats indicated the water-line to be considerably lower. I have a large high-pressure engine underground here, and I have been more than commonly annoyed with priming, and have tried various methods, but without effect; in the course of working out these experiments, I have most certainly discovered the cause of the priming, but the cure, in this case, although certain, is not a convenient one. I first attempted to separate the water from the steam after it left the boiler by the means represented in the foregoing sectional view, which is on a scale of half an inch to a foot.

Above the boiler A (which is long and circular, with hemispherical ends,) was placed a vessel or separator; A *a* into which the steam was admitted by the pipe B, the mouth of which was twelve inches above the bottom of the vessel A; alongside of this a small pipe *c*, leading under the water-line, was placed, and the steam to the engine was taken from the top of the vessel A by the eduction-pipe E. My idea was, that when the foam entered the separator the steam would flow off at the top, and the water would fall down by its gravity and get into the boiler again by the pipe *c*; but I was sadly disappointed; the engine continued to prime as bad as ever, and the old and expensive method of putting tallow into the boiler was again resorted to. I began to observe, that for a few days after the boiler was cleaned no priming occurred, and therefore ordered the boiler to be cleaned once a week, and ever since we have had no priming but on Friday evening and Saturday after the dirt accumulates. The silt which occasions this, is the finer portions of shale taken up by the water in passing through a coal-waste; it attaches itself to the bottom and sides of the boiler in feathery flakes, which gradually extend far up above the water-line. That this is the cause of the foaming, there cannot be a doubt; for when there has been any unusual traffic in the mine from which the boiler is fed to make the water dirtier than common, then the priming begins much earlier in the week; and, moreover, I have often seen the priming produced when the boiler was clean, by peas-meal or horse-dung being put in to stop a leak. This favourite cure of our engine-men's cannot be used from the absolute certainty that the engine will prime all that and the next day (moss is found to tighten a leak without priming). It would therefore seem that this troublesome defect of many high-pressure engines arises from the river mud,* attaching itself to the sides of the boiler; but how it acts, I must leave to be settled by those who have windows to look in and see.

I trust, sir, you will give these remarks a place in your useful pages, and I shall be glad if they elicit more practical remarks on the subject; and

Your most obedient servant,

L. LANDALE.

Wemyss Cottage, July 30, 1836.

MR. HOWARD'S REJOINDER TO MR. SYMINGTON.

Sir,—In reply to Mr. Symington's last communication, I must, in the first place, freely tender my apology for stating that I had seen him at the King and Queen Iron-works, when (his own denial being quite sufficient evidence) such was not the case. Even had it been so, I did not mean for a moment to impute to him the motive of having done so, as he suggests, I must say, gratuitously, for the purpose of pirating my invention. But I will explain. In the spring of 1834, I was em-

* The comminuted shale of the mine was once fine river silt, the same as this.

ployed in fitting his Majesty's steam-vessel Comet with my patent vaporisers and condensers; and the Admiralty purposed trying a wheel invented by Mr. Symington at the same time. On my pointing out, however, the inconvenience and uncertainty of trial likely to result to both parties by this arrangement, it was very properly abandoned by the Admiralty, and the wheel was subsequently tried in the Alban. In the mean time I called on the manufacturer of the wheel at Bankside (Mr. Brough, if I remember the name correctly), and he came to Rotherhithe to inspect my engine at work there. Again, by appointment, he came with, and introduced to me, *as I fully understood* (and here must lie the error), Mr. Symington as the inventor of the wheel in question, to whom I explained my invention in every particular—the more so as he was then interested in the efficiency of it to propel his wheel. These facts will, I doubt not, give Mr. Symington a clue by which to discover the cause of my mistake.

Now to the more important point at issue between us. Will Mr. Symington state, that he does not take the same principle or method of condensation as that previously patented by me? Will he state, as he seems to insinuate, that I have not caused the process to answer completely, that is, I now say, as completely as any pre-existing plan of condensation *whatever?* And will he inform me where *he* has previously done so? Upon this evidence I will ground the validity of my claim to priority of invention.

When Mr. Watt discovered and patented the splendid improvement of condensing the steam in a vessel apart from the cylinder, he invented a *principle* or *new method;* and no subsequent alteration or even improvement upon it could deprive him of his patent right during the term for which it was granted. Whether the condenser was placed in a well or in a garret—whether the steam was condensed by injection or external cold water (a material difference)—who, even with the most contracted view of justice, would deny that he was the inventor of the process, and legally and morally entitled to the benefit of it; provided, as was the case, his own arrangement proved perfectly efficient in practice. *Although I do not pretend to place my method of condensation, by withdrawing the warm water from the condenser and injecting it again amidst the steam, the heat in the mean time having been abstracted from it,* in competition with Mr. Watt's invention, for the result is far, very far inferior indeed, to that obtained by his improvement on the then existing steam-engine; yet I place myself on the same ground with respect to others who attempted to practise, *in combination with his process,* any alterations in the arrangement or details. In this position I presume Mr. Symington to stand with respect to myself.

I may further state, that my specification provides for such contingencies, otherwise a patent is mere waste parchment; and that a description of both the method of vaporisation (by far the more important, by-the-bye,) and condensation is given in the last edition of Dr. Lardner's able treatise on the steam-engine, and to which work Mr. Symington himself alludes in his communication in your No. 677. The specification further states, that the result of the plan of condensation when employed with boilers, will be *a very rapid and effectual condensation of the steam, with the advantage of continually returning to the boiler the same water, or nearly so, and also a great reduction in the size of the air-pump.*

Your most obedient servant,

THOMAS HOWARD.

7, Tokenhouse Yard, London,
August 24, 1836.

RAILWAY TRANSIT AND INLAND NAVIGATION.

(From the Times' Report of First Day's Proceedings of the Bristol Meeting of the British Association, August 22, 1836.*)*

The subjects arranged for discussion were two—on certain points connected with the theory of locomotive-carriages, and on the application of our knowledge of the phenomena of waves to the improvement of the navigation of shallow rivers and canals.

Professor Mosley opened the first point by stating that there were many gentlemen present acquainted with the practical working of steam-engines, but the relations between the theory and practice were not perfectly understood. The piston of a locomotive-engine was pressed on either side, one resulting from the friction on the road, and the other from the passive friction of the engine itself. If it was lifted from the ground, a person endeavouring to move the wheels would find a resistance equal to 150 lbs. The cause of the resistance was this—that the traction upon the engine induced additional friction

of the machinery, and that probably was one-fifth of the whole amount of friction. If the engine moved without a train, there would be a passive resistance; if a train was attached to it, there would be induced a considerable friction of the machinery. There were, in fact, three causes of resistance—the friction of the carriage, the passive resistance, the additional friction by the train—the first and last varying according to the weight of the train. On the other side there was the expansive force of the steam. The quantity of work done was greater as the velocity was less. Inclined planes on railroads he considered to be injurious.

Dr. Lardner said he had given a good deal of evidence before Parliament upon this subject. In all inclined planes more steep than the angle of repose there was an unfavourable loss of power. The portion of mechanical force expended in ascending the plane was not repaid in the descent. Theoretically they might take advantage of the accumulative matter as a deposit of momentum, and make a perfect mechanical compensation, but that was not the case in practice, because they were obliged to check the velocity in the descent. He had never said, as had been represented, that inclined planes were not of importance, because the friction in the ascent was given back in the descent. When the engine was descending, great part of its steam was going off in the safety-valve, therefore inclined planes were injurious. All the experiments led to the conclusion, that every effort should be made to attain as perfect a level as possible. Every departure from a level, though it saved a quantity of capital in the construction of a road, entailed an everlasting expense. The result of some experiments he had made was this—that in the ordinary state of the roads, the force necessary on a level was 7lbs. per ton; but he found an extraordinary difference depending on the state of the rails, a difference amounting in some instances to such an extent that the friction was reduced to 4lbs. When it rained and the rails were wet, he found the friction reduced to 4lbs., but as soon as the rails became again dry, the friction was again 7lbs.; he should therefore suggest, that two watering-pots should be placed before the wheels, so as to give the engine an additional power of nearly 50 per cent. There was another point with regard to dust: he had let himself down a very steep inclined plane, and when he attained a speed of 60 miles an hour, he had a quantity of sand put on the rails, and the consequence was, that the steam-engine came to a stop.

As to the second subject for discussion—namely, "On *the application of our knowledge of the phenomena of waves with a view to the improvement of the navigation of shallow rivers and canals.*"

Mr. Russell made some very lengthy, but very interesting observations, the substance of which was this,—where canals did exist, there was no man but wished they should be conducted in the most profitable manner. Newton's law had been confirmed, that the resistance was in proportion to the square of the velocity. The difference in the amount of resistance between a vessel drawn on a canal by a horse, trotting or cantering, was from 108 to 136. He would read from a paper the results of various experiments he had made, in which they would perceive a very curious fact as regarded the pace of eight miles an hour. The table was thus:—

			Lbs.
4	miles an hour gave a resistance of	..	33
6	ditto ..	ditto ..	.. 91
$7\frac{1}{2}$	ditto ..	ditto ..	.. 265
$8\frac{1}{2}$	ditto ..	ditto ..	.. 215
9	ditto ..	ditto ..	.. 235
11	ditto ..	ditto ..	.. 246
12	ditto ..	ditto ..	.. 352
15	ditto ..	ditto ..	.. 444

But at the rate of 20 miles an hour the vessel skated along the surface of the water, and there was scarcely any resistance at all. When a vessel was propelled at a great velocity and then stopped, it produced a wave varying in its form, according to the mass of the water, and he had followed such a wave a mile and a half; the velocity of the wave was uniform, and independent of the velocity of the vessel. If the vessel was going four miles an hour, this wave would go at the rate of eight miles an hour, and he had seen a large wave overtake a small wave and pass it. The waves never exceeded in height the depth of the quiescent water. Vessels at a slow velocity did not divide the water as was generally supposed, but pushed it forward in the shape of a wave; but where the velocity was greater than eight or nine miles an hour, the vessel did divide the water. It was possible to bring the vessel completely upon the wave, and then you had scarcely any resistance. A velocity of between four and six miles an hour on canals was unprofitable; beyond 11 miles an hour you had a high velocity, and comparatively little resistance. He recommended a rectangular canal where it was intended the velocity should be great, as by widening a canal with sloping banks you increased the resisting power.

The Rev. Mr. Whewell agreed with Mr. Russell in nearly all his remarks, which he considered most valuable and important to be considered. It was clearly ascertained that the greater the velocity the less the resistance.

Mr. Russell felt convinced that by adopting a considerable velocity, the Atlantic might easily be crossed with steam-vessels.

The Chairman (the Marquis of Northampton) said, that the observations of Mr. Rus-

sell were most important, and that the gratitude of the country was due to him for his experiments.

IMPROVEMENT IN NAPIER'S RODS.

(*From Second Day's Proceedings.*)

In the section of mechanical science, Mr. Hawkins read a paper on an improvement upon Napier's rods, for facilitating the multiplication of high numbers with little liability of error, the invention of Mr. J. N. Copham, of Bristol.

The invention consists in cutting each of Napier's rods into cubes, and in stringing the cubes together by means of pins passing through two perforations in each cube, made at right angles to each other parallel to the figured sides.

By this arrangement the cubes may be readily placed in such positions in respect to each other that the product may be obtained by addition only, without the necessity of transcribing the figures from the rods previous to the addition, thus avoiding a great liability to error, and effecting a saving of time in the calculation.

The pins are in two sets with heads of two different shapes.

On the heads of one set of pins are marked 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. respectively, the same pin having the same number on each side of the head; but the number on one side of the head is inverted in respect to the position of the number on the other side.

The heads of the other set of pins are also numbered 0. 1. 2. 3. 4. 5. 6. 7. 8. 9., but the pin having 0. on one side of the head, has 9. on the other side; that having 1. on one side, has 8. on the other, &c. The figures in this set, also, are inverted in respect to those of the opposite side of the head.

The cubes are kept strung on those pins which have the same figures on each side of the head: 10 cubes on each pin representing one of Napier's rods.

On the pin marked 0. all the cubes are marked 0. on both sides.

On the pin marked 1. the cubes are marked 0. 1. 2. to 9. on one side, and 9. 8. to 0. on the other side. The numbers on the two sides of each cube, on being added together, make 9.

On the pin marked 2. the cubes are marked 0. 2. 4. 6., &c. on one side, and 18. 16., &c. on the other side. The numbers on the two sides of each cube, on being added together, make 18.

And thus the numbers on the cubes of each pin are all consecutive multiples of the numbers on the head of the pin; and the two numbers on each cube on being added together make the number on the head multiplied by nine—the numbers ascending on one side, and descending on the other.

RESUSCITATED INVENTIONS.

Sir,—In a recent Number of *The Repertory of Arts* there is a copy of a specification of a patent granted to Mr. Booth for improvements in steam locomotive-carriages; one of which improvements is the "application of a throttle-valve to the eduction-pipe of the cylinders." The idea of this is not new; one of the early volumes of the *Mechanics' Magazine* contains an account of the application of a throttle-valve to the eduction-pipe of a locomotive engine used on one of the railroads at a northern colliery several years before. The mere mention of this circumstance tends, in some measure, to show the increasing value of the *Mechanics' Magazine* as a record of useful and valuable inventions.

The mode of traction through canal tunnels given in a recent Number of your work (though displaying considerable ingenuity as regarding the arrangement of some of the parts) is also not new. In the year 1828, I was on board a similar sort of boat, and passed in it through the tunnel at Islington. The boat was nearly of the width of the tunnel, and its sides were protected by guard-rails; the chain (of common construction) made two or three turns round an iron roller, and passed in and out at head and stern of the boat through a wrought-iron tube. Motion was given to the said roller by a high-pressure engine of 4-horse power, the cylinder of which was fixed in a horizontal position with the usual contrivance for reversing motion. This tunnel, about 900 yards long, was traversed by this boat, with two Thames barges in tow, in about 15 minutes. Coke was chiefly used as fuel; and it is worthy of remark, that at the head of the boat the heat and sulphurous smell was intolerable, even for a few seconds. Placed at the stern, however, no other inconvenience was felt than the rush of cold air. This boat, I understand, not sufficiently remunerating the owner, was soon after discontinued, and the old and dangerous method again reverted to. The horses generally employed in towing the barges might be shipped on board a spare boat furnished with a roller and chain as above described, and their services would doubtless be eligible in towing the barges.

I am, Sir, yours, &c.

I. Elliott.

EXTRACTION OF THE CUBE ROOT—SHORT METHOD OF CALCULATING THE CONTENTS OF VESSELS.

Sir,—In looking over some of the back volumes of your valuable miscellany, I observed in pp. 330 and 331 of vol. xvi. two methods of extracting the cube root, which I am somewhat surprised have not been noticed in some of the subsequent Numbers, more especially as the former of the two methods (Mr. Laker's), in my opinion, as well as in that of several of my acquaintance, is of great practical utility, being very concise and also applicable to every case that can occur; but the latter method, communicated by F. B., is impracticable, except in a *very few* cases, and consequently useless. This is easily proved by taking the example illustrating the first method, when F. B. would find himself involved in literally an endless maze of figures without any probability of obtaining the required root.

Having also a short time since been applied to for a short method of finding the content of cisterns, &c., in gallons or bushels, by knowing the length, breadth, and depth, I naturally turned to your museum of information for the required rule, where I soon discovered in the Number for January 19, 1828, a rule apparently to the purpose; which, however, being calculated for Winchester bushels, was inapplicable to the case in point, and as no rule for finding the content in imperial measure has since appeared, I take the liberty of offering the following formula, the insertion of which, should you deem them worthy of a place in your Magazine, will oblige,

Yours, &c.

J. L.

Maidstone, Aug. 9, 1836.

Short Method of finding the Content of a Parallelopipedon in Imperial Measure.

Let $l =$ length, $b =$ breadth, $d =$ depth, all in feet, and $c =$ content.

Then, if c be required in gallons . . . . $\dfrac{81\,lbd}{13} = c$.

If c be required in bushels, the formula becomes . . . $\dfrac{10\frac{1}{8}\,lbd}{13} = c$.

Example 1.—In a tank where $l = 6$ ft. 3 in., $b = 3$ ft. 3 in., and $d = 4$ ft., required the content in imperial gallons:—$\dfrac{81 \times 6{\cdot}25 \times 3{\cdot}25 \times 4}{13} = 506\frac{1}{4}$ gallons, the content.

Example 2.—Required the content in imperial bushels of a corn-bin, when $l = 8$ ft., $b = 4$ ft., and $d = 3$ ft.:—$\dfrac{10\frac{1}{8} \times 8 \times 4 \times 3}{13} = 74\frac{10}{13}$ bushels, the content.

In some cases the readiest method for bushels will be found to be $\dfrac{10\,lbd}{13} = c$, nearly; then to every 10 bushels thus found add 1 gallon.

MANUFACTURE OF BEET-ROOT SUGAR IN RUSSIA.

Sir,—The manufacture of beet-root into sugar in the Russian empire has of late become very extensive; there are already no less than twenty-five large establishments for this purpose in different parts. Thinking that the following account of one of the principal of these establishments, viz. Micharlofsky Sugar-works in the government of Tula, the property of Count Bobrinsky, may be interesting to the English public, I send it for insertion in your widely circulated Journal:—

The quantity of beet worked in the year 1835 was 260,000 poods = to 85,357 cwt. 0 qr. 16 lbs.; the sugar produced from it, 15,600 poods = 5014 cwt. 1 qr. 4 lbs.

Price of a pood of beet	15 copecks.
Expense in working do.	35 do.
	50

Produce of one pood of beet $2\frac{2}{5}$ lbs. of raw sugar at 1 ro. 10 co. per lb.

The number of men employed 250.

The quantity of land required to produce the beet 350 deciatines = 945 acres.

The beet is generally taken from the

peasantry instead of the obrok or fine they, as serfs, would have to pay their baron.

The proprietor of this manufactory is an accomplished and amiable nobleman; his experiment in this case has been highly successful.

One great evil is the impossibility hitherto experienced of keeping the roots any length of time, which makes it expedient they should be worked as soon as possible after they are taken from the ground.

I have been favoured with a specimen of raw and refined sugar from these works, of which I send you a small sample, and am only sorry the distance does not allow me to send a larger one.

The Russian lb. is equal to 14¼ oz. English; a pood 40 lbs. Russia = 36 lbs. English; a rouble = 100 copecks; sterling value 10½d.

Your constant reader,
J. K.

Petersburg, June 25, 1836.

[The samples sent are excellent; the raw sugar not quite so good as that from the cane, but the refined equal to the best products of our refineries.--Ed. M. M.]

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 27TH OF JULY AND 25TH OF AUGUST, 1836.

Nathan Bailey, of Leicester, frame-smith, for certain improvements in, or additions to, machinery for manufacturing stocking fabric. August 1; six months to specify.

John Thomas Betts, of Smithfield Bars, London, rectifier, for improvements in the process of preparing spirituous liquors in the making of brandy; being a communication from a foreigner residing abroad. August 3; six months.

Webster Flockton, of the Spa-road, Bermondsey, turpentine and tar distiller, for certain improvements in preserving timber. August 3; six months.

John Archibald, of Alva, Stirling, Scotland, manufacturer, for certain improvements in machinery or apparatus for carding wool, and doffing, straightening, piecing, roving, and drawing rolls or cardings of wool. August 4; six months.

Ramsay Richard Reinagle, of Albany-street, Regent's Park, Esq., for improvements in the construction of carriages for the conveyance of persons and goods or merchandise. August 6; six months.

Thomas Binns, of Mornington-place, Hampstead-road, civil engineer, for improvements in railways and in the steam-engines to be used thereon and for other purposes. August 6; six months.

Thomas John Fuller, of the Commercial road, Limehouse, civil engineer, for a new or improved screen for intercepting or stopping the radiant heat arising or proceeding from the boilers and cylinders of steam-engines. August 9; six months.

John Burns Smith, of Salford, Lancaster, spinner, and John Smith, of Halifax, dyer, for a certain method or methods of tentering, stretching, or keeping out cloth to its width, made either of cotton, silk, wool, or any other fibrous substances by machinery. August 10; six months.

Henry Pershouse Parkes, of Dudley, Worcester, iron-merchant, for improvements in flat pit chains. August 11; six months.

Joseph Douglass, of Morpeth, Northumberland, rope-maker, for improvements in the manufacture of oakum. August 11; two months.

Edward Light, of Royal-street, Lambeth, civil engineer, for certain improvements in propelling vessels and other floating bodies. August 11; six months.

William Newton, of Chancery-lane, for improvements in the means of producing instantaneous ignition; being a communication from a foreigner residing abroad. August 11; six months.

Robert Allen Hurlock, of Whaddon, Cambridge, clerk, for improvements in axletrees. August 11; two months.

Joshua Butters Bacon, of Regent's-square, gentleman, for improvements in the structure and combination of certain apparatus employed in the generation and use of steam. August 13; six months.

Thomas Gauntley, of Nottingham, mechanic, for certain improvements in machinery for making lace and other fabrics, commonly called wash machinery. August 15; six months.

George Leech, of 25, Norfolk-street, Islington, carpenter, for a certain improved method of connecting window-sashes and shutters, such as are usually hung and balanced by lines and counterweights with the lines by which they are so hung. August 15; six months.

William Fothergill Cooke, of Bellayse College, Durham, Esq., for improvements in winding up springs to produce continuous motion, applicable to various purposes. August 17; six months.

Joseph Hall, of Margaret-street, Cavendish-square, plumber, for improvements in the manufacture of salt. August 17; two months.

Francois de Tansch, of Percy-street, Bedford-square, military engineer to the King of Bavaria, for improvements in apparatus or machinery for propelling of vessels for raising water, and for various other purposes. August 25; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 21ST OF JULY AND 20TH OF AUGUST, 1836, INCLUSIVE.

William Wainwright Potts, and William Machin, china and earthenware manufacturers, and William Bourne, manager, all of Burslem, Stafford, for an improved method or process, whereby impressions or patterns in one or more colours or metallic preparations are produced and transferred to surfaces of metal, wood, cloth, paper, papier-machée, bone, slate, marble, and other suitable substances, prepared or otherwise not being used or known as earthenware, porcelain, China, glass, or other similar substances. Sealed July 29.

Walter Hancock, of Stratford, Essex, engineer, for an invention of an improvement or improvements upon steam-engines. July 29.

John M'Dowall, of Johnstone, Renfrew, Scotland, engineer, for certain improvements in machinery for sawing and cutting, and likewise in the mode of applying motive power thereto. August 2.

Henry Walker Wood, of No. 29, Austin-friars, London, merchant, for certain improvements in certain locomotive-apparatus. August 4.

John Burns Smith, of Salford, spinner, and John Smith, of Halifax, dyer, for a certain method or methods of tentering, stretching, or keeping out cloth to its width, made either of cotton, silk, wool, or any other fibrous substances by machinery. August 11.

Henry Gore, of Manchester, machine-maker, for certain improvements in the machinery or apparatus for spinning or twisting cotton and other fibrous substances. August 11.

Samuel Hall, of Basford, Nottingham, gentleman, for improvements in propelling vessels, also improvements in steam-engines, and in the method or methods of working some parts thereof; some of which improvements are applicable to other useful purposes. August 15.

Thomas, Earl of Dundonald, of Regent's Park, Middlesex, for improvements in machinery or apparatus applicable to purposes of locomotion. August 15.

Joshua Bates, of Bishopsgate street, London, merchant, in consequence of a communication by a foreigner residing abroad, for certain improvements in machinery for cleaning and preparing wool. August 19.

NOTES AND NOTICES.

The New Steam-Boat Novelty.—The recent successful experiment of driving this boat, of the largest class, with anthracite coal, against the tide and a strong current from heavy rains, at the rate of 16 miles in the hour, has caused much remark in our city, as an astonishing fact of great importance on the subject of fuel, which may lead to revolutions in steam navigation. Dr. Knott, the distinguished President of Union College, is the well-known proprietor of the Novelty, which he constructed, we believe, with machinery modelled after his own ingenious invention, so as to adapt it ultimately to the same economical principles of combustion which have given such deserved celebrity to his patented stove. The fact of the practicability of using anthracite being now ascertained so as to produce as great a degree of speed as pine-wood, will no longer compel steam-boat proprietors to import their wood at exorbitant prices from the remote forests of Maine and the shores of the Chesapeake. Nearer by, and almost at our own doors, we have the anthracite coal-mines of Pennsylvania, of every possible variety, in exhaustless quantities. In the trips to Albany for one season the difference in cost between wood and anthracite for the Novelty, it is ascertained, would be 19,000 dollars in favour of coal. The successful navigation of the Atlantic from America to Europe is made certain. Among the other great advantages would be the vast saving of human life, as it is believed the steady, intense, radiated heat of anthracite, will be in some degree a security against those sudden accumulations which arise from the inflammable blaze of pine-wood. There is also an entire freedom from the annoyance of smoke, and the danger of fire from showers of sparks. Wood is now selling at the Hudson at five or six dollars a cord. The cost, in fact, of pine-wood is about double that of anthracite. The passage and freight, therefore, must soon be reduced to half the present rates. The Novelty is remarkable for the ease with which she glides through the water, the motion being without any jarring.—*New York Evening Star.*

Home-Grown Flax.—We understand the agriculture practice of sowing flax in this part of the country, for domestic purposes, is becoming much more general than it was formerly. The returns from Riga and American seed have, in many instances, been very great. The Dutch seed has also been found to answer well; and there is every reason to think, if farmers would direct their attention more to the cultivation of this crop, it would turn out a profitable one, not only for family purposes, but as an article for sale. The importance of flax crops in Ireland may be judged from the fact, that there has lately been brought into the market in Derry as much as 200 tons per week, averaging in value from 40*l.* to 80*l.* per ton; and there has been imported this season, at Belfast alone, above 9000 hogsheads of flax-seed, Riga, America, and Dutch.—*Aberdeen Paper.*

Embossing on Wood.—A new and ingenious method of embossing on wood has been invented by Mr. J. Straker. It may be used either by itself, or in aid of carving, and depends on the fact, that if a depression be made by a blunt instrument on the surface of wood, such depressed part will again rise to its original level by subsequent immersion in water. The wood to be ornamented having first been worked to its proposed shape, is in a state to receive the drawing of the pattern; this being put in, a blunt steel tool, or burnisher, or die, is to be applied successively to all those parts of the pattern intended to be in relief, and at the same time is to be driven very cautiously, without breaking the grain of the wood, till the depth of the depression is equal to the subsequent prominence of the figures. The ground is then to be reduced by planing or filing to the level of the depressed part; after which the piece of wood being placed in water, either hot or cold, the parts previously depressed will rise to their former height, and will thus form an embossed pattern, which may be finished by the usual operation of carving.

Maise Sugar.—Dr. Ballas having sent two specimens of the maise sugar to the French Academy of Sciences, M. Biot has submitted them to certain effects of polarisation in order to ascertain their precise nature. The deviation of the polarised rays to the right of the place of polarisation in an aqueous solution of this sugar after filtration, and the proportion of its inversion to the left by the addition of liquid sulphuric acid, have been found by M. Biot to agree with the pure sugar derived from the cane.—*Athenæum.*

Beneficial Effects of Railways.—Some idea of the employment which railways will find for the labouring classes may be formed from the fact, that at this moment between 10,000 and 11,000 men are employed on the London and Birmingham Railway only.—*Spectator.* Taking this number as data, the average of accidents which occur in the prosecution of the works, is certainly under that which happens to an equal number of workmen engaged in the ordinary occupations of bricklayers, masons, carpenters, labourers, and so forth.

Time and Temperature Measurer in One.—M. Arago announced at the last sitting of the French Academy of Sciences, that a Danish watchmaker has invented a watch which at the end of the day indicates the mean temperature of twenty-four hours.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

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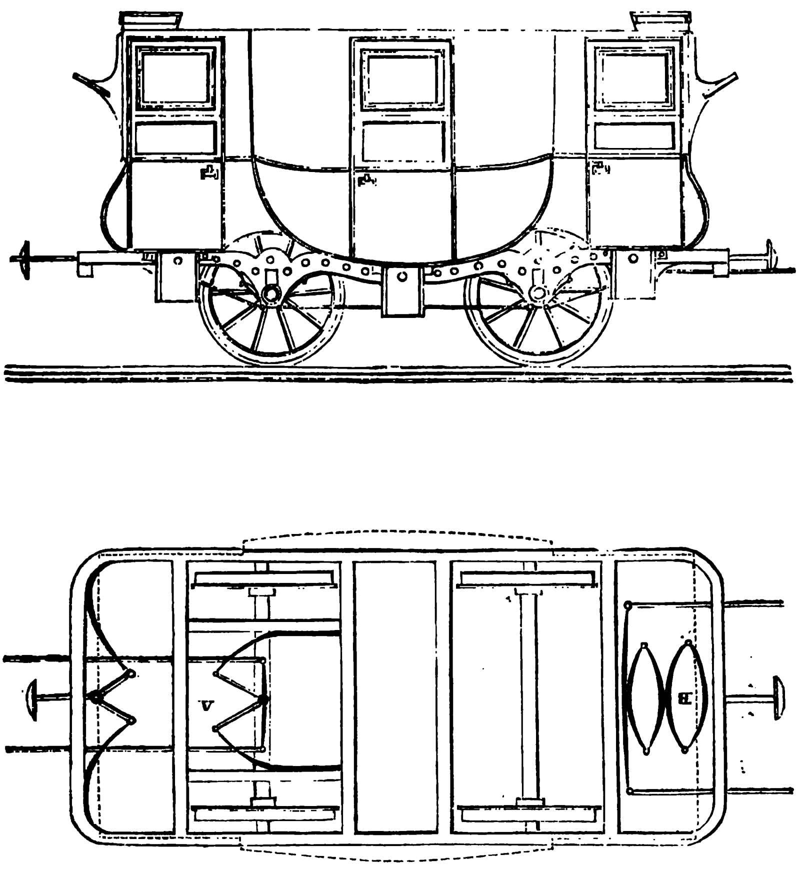
BIRCH'S FIRST-CLASS RAILWAY-CARRIAGE.



BIRCH'S FIRST-CLASS RAILWAY-CARRIAGE.

Sir,—In the month of November, 1835, the London and Birmingham and Great Western Railway Company put forth a proposal inviting engineers, and others, to a professional competition in designs for first-class carriages, which was liberally backed by the promised premiums of 100 and 200*l.*

As one (and probably one of the humblest) of the competitors, I essayed my skill, and designed what I considered to be a carriage meeting the views of the Company; I was, however, one of the unsuccessful candidates. Thinking, nevertheless, that some of the arrangements may not be altogether deficient in originality or utility, I solicit its insertion in your widely-circulated work. The following is a copy of the directions given to the competitors:—

" London and Birmingham and Great Western Railways

" *First-Class Carriage.*

" To be capable of accommodating at least twelve passengers. A convenient arrangement for a greater number is very desirable, and will be preferred if it should not involve other objections.

" May be placed on four or more wheels; if on six, the interval between the most distant axles, not to exceed ten feet.

" To rest on springs.

" Particular attention to be directed to the elastic mode of connecting one carriage with another; as also the various expedients which are already employed to prevent the jerking action of the carriage when the train is put in movement, and to the shocks which are generally experienced when the velocity of a train is lessened, or when it is brought to a state of rest.

" It is considered desirable to reduce, as far as practicable, the height of the body of the carriage from the ground, so that it be not less than twelve or fourteen inches above the level of the rail.

" The extreme width of any portion of the body of the carriage not to exceed seven feet.

" In furnishing the above particulars, the Directors are to be understood as simply stating what appears to them to be desirable with reference to the present state of railway experience in the construction of carriages for passengers. Plans, therefore, which may not be in strict accordance with these data will receive the most mature consideration, according to the advantages they may severally appear to possess."

The following are the few observations I addressed to the Directors:—

" *In submitting for* your approval a design for a first-class carriage, I have adhered as nearly as possible to the printed instructions, and beg to offer a few observations by way of explanation.

" The body is in three divisions, one double and two single. The double division is intended to carry eight persons, and each of the single ones four, which, with the two conductors' seats, allows room for eighteen passengers. The depth of and (in the former) the space between the seats is considerably more than those afforded by ordinary stage-coach conveyances, and the consequent ease and comfort of the passengers are thereby insured.

" The carriage having both ends alike, will not require turning on the rails; and may be drawn or propelled without altering the position of the passengers. The extreme length of it is fourteen feet; the width, six feet six inches; the height from the rail to door is two feet two inches; and the whole height is seven feet.

" It will be observed, that the springs attached to the connecting-rods at each end of the carriage are different, and must be a matter of choice or experience. That marked A acting upon cranks will throw the pressure of the springs outwards, and will consequently prevent, or considerably lessen, the concussion and jerking action upon the train being put in motion or stopped.

" The one marked B acting with sliding-rods, drawing from a long spring, and buffing against a double nut-cracker, will have a similar effect.

" From the axles cranks are attached to the springs, and pressing outwards will allow the wheels to rise in the slots, and surmount any obstruction of five or six inches without throwing the body out of its equilibrium.

" I presume that a tender will be attached to the train for the conveyance of luggage; but if it is deemed indispensable, an imperial, and rods may be attached to the top, for the carrying of the same. There is room for stowage under each of the seats.

" I remain, Gentlemen, with respect,
" Your most obedient servant,
" EUGENIUS BIRCH.

" Feb 1, 1836."

NEW SYSTEM OF GEOLOGY.

Sir,—I have read with much interest the various articles upon the " Electrical Theory of the Universe," and I am glad to find, from Kinclaven's last letter on the subject, that no great danger is to be apprehended of this earth or any of the other planets being " whirled into the body of the sun." But, Mr. Editor, there is another new system of geology which is now

making some noise, the following account of which I copy from the catalogue for the present year of the Society for the Illustration and Encouragement of Practical Science, Adelaide-street:—

"No. 10, p. 46.—A Geological Globe, presented by Sir John Byerley.

"This globe, the invention of which is due to M. Guesney, of Constance, in Normandy, is intended to show the changes on the earth's surface, produced by the precession of the equinoxes, whereby the pole of the equator revolves round that of the ecliptic in 25,920 years (Delambre).

"The fixed circle is the ecliptic, or that line to which the sun would be vertical in the course of a tropical year, were there no diurnal motion. The moveable circle represents the equator, preserving the same angle with the ecliptic by cutting it in different points at every succeeding equinox; by which means the pole of the earth passes through 46° 56′ of latitude in about 13,000 years; by this means the Oural mountains become in the latitude of Mexico and Kamschatka within the tropics. The pole will pass over France and Germany; and then Edinburgh will be due south of London. The author thus accounts for the variation of the magnetic needle, the discovery of tropical fossils in the polar regions, the advance and retreat of the sea, the relative height of mountains, earthquakes, volcanoes, &c."

According to Mr. Mackintosh's theory, all the inhabitants of this earth on some luckless day are to be roasted alive; but according to the above theory, all the inhabitants of Europe, at least, are to be frozen to death unless they remove their quarters. Edinburgh is to be due south of London in the space of 13,000 years! When this takes place, England will not be troubled with many Scotchmen—they may then blow up the bridge of Berwick, for "Sandy" will still direct his course to the south (a favourite Scotch point of the compass), and will arrive at what is now the polar regions, but which will then be a most delightful climate. But, Mr. Editor, on this subject I should like to have the opinions of some of your scientific correspondents; my present opinion of the matter is, that it is all nonsense.

I am, Mr. Editor,

Yours with respect,

AN OLD CORRESPONDENT.

Aug. 29, 1836.

M'GAULEY'S LOCOMOTION BY GALVANISM.

The announcement by the Rev. Mr. M'Gauley at the meeting of the British Association at Dublin last year, that he had invented a method of applying galvanism as a motive-power, has excited considerable interest in the mechanical world. The whole scheme has, however, come to nothing, as will be seen by the following statement of the proceedings upon the subject, which we extract from the *Athenæum's* report of the second day's (Tuesday, August 23rd) proceedings of the Association at Bristol:—

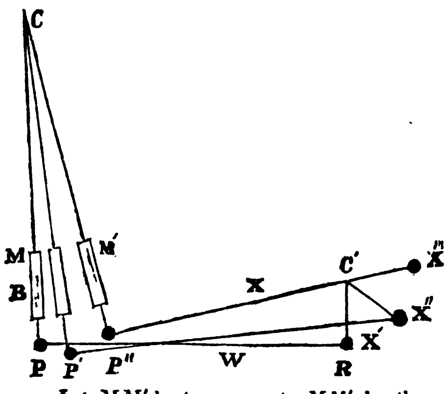
The Rev. J. W. M'Gauley read "A series of Experiments in Electro-Magnetism, with reference to its application as a Moving Power."

Previously to the detail of the experiments on this subject, he thought it might be interesting to the Section to relate what he had done since the last meeting of the Association, in the application of electro-magnetism to machinery. He had intended, originally, to have exhibited the improvements, but should content himself, for the present, with the *detail*, rather than the *exhibition*. He was obliged to confess, that he was the less anxious prematurely to publish results, since he found that the working model of last year, given to the Section, undoubtedly with the intention of its future improvement, or the pursuance of experiments by other members, had led, on several occasions, to the production of papers, and the exhibition of models, by those from whom it might not be expected—with a pretension to originality, but with no change in the principle, and almost none in the details.

The working model exhibited to the Sections at the last Meeting of the Association must be acknowledged as a proof, to some extent, at least, of the applicability and the manageableness of electro-magnetism as a moving power; but the question then remaining was, whether or not it was likely to be applied to useful purposes; for this, several things remained undone.

Powerful magnets were to be constructed. The ordinary formation of electro-magnets furnishes us, at best, with an apparatus clumsy in the extreme, and, as we shall see, of very limited power. This arises from the very nature of an electro-magnet; for the lifting power may be very great, although the attracting power at a small distance may be very trifling. There must be a limit, also, to the size of these magnets, for, if the mass of iron be too great for the helix, it is not saturated with magnetism, and the helix cannot be unlimited, as, beyond a certain

distance from the iron, its action is nothing,—in some cases, perhaps, as we shall see, even injurious. The effective distance of the helix from the iron cannot be great, since its action, probably, decreases in the inverse proportion of the square of that distance. This difficulty cannot be obviated, as some have imagined, by causing the electrical currents to circulate through the mass of iron, uniting together a number of coiled bars. This would present an arrangement probably similar to a permanent magnet, the masses of iron acting on each other by induction, the reversion of the poles would be very slow, or altogether impossible. The *action* of the magnets, rather than their *masses*, must be united; but in this new difficulties occur. Their action must be simultaneous, or the machinery will be broken, or ineffective; the time *after* reversion, and during which a *bar can* be thrown off a magnet, is extremely short—hence one reason why it is difficult to unite the action of several magnets. But let us suppose that we have obtained a simultaneous reversion of the poles and throwing off of the bars—a thing totally impossible, he conceived, from the number and complication of circumstances by which it is influenced—how shall this action be applied to machinery? If the fly-wheel of a steam-engine, from the shutting off of the steam, be not impelled by the engine while it continues in motion, it drags the piston, uninjured, through the cylinder; but suppose something to retain the piston in one position, without stopping the wheel, the effect were highly injurious—this is exactly what must frequently happen in electro-magnetism. It is impossible to reverse the poles even of one magnet, in such a manner that the position of the bars shall always correspond with the position of the crank and fly-wheel.



Let MM' be two magnets, MM' be the *space through* which B, the bar, travels in causing half the revolutions of the crank C'X, while B is moving, so that its extremity shall be at P'; then C'X shall have become C'X'' while it is going to P'', C'X' shall become C'X''', but if when the crank C'X is in the position of C'X''', one of the dead points, the bar is not ready to leave M'; or, in other words, if the magnet which holds it be not ready at once to send it off—a thing very probable—the fly-wheel continues to revolve by its own inertia, and the machinery is broken, or the bar is torn from the magnet, which often has a curious and perplexing effect on the reversion of the poles.

A better reversing apparatus was to be obtained. The one of last year, though perfectly successful, required the agency of mercury, which, for many reasons, is objectionable; it becomes oxidated, then contact is imperfect, and the level in the cups, which is of the last importance, is destroyed: it is liable to a thousand accidents, not to speak of its destroying the wires of the apparatus itself.

Again, the form of the apparatus, whether mercury be used or not, must be *changed*, and the *principle* of the one now exhibited to the Section adopted, since the apparatus, which will reverse the poles of one magnet, will not with speed or certainty reverse the poles of two or more, when worked by the engine itself. The apparatus shown to the Section had been used with great success in the reversion of the poles of four powerful magnets.

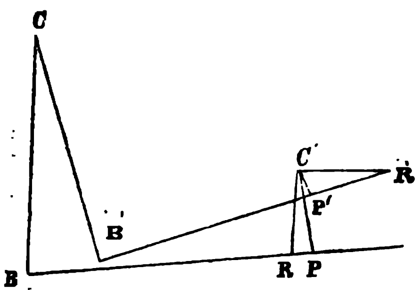
The attachment of the reversing apparatus to the machine becomes difficult, when more than one magnet is used, for reasons with which he would not then occupy the Section. He believed he might mention, that he possessed an engine of considerable power, in which these difficulties were overcome.

The experiments he should detail to the Section were numerous and complicated; he had taken every means to secure their accuracy; some of them appear anomalous, but were undoubtedly modified by circumstances, many of which are so obscure, that he has not been able yet to detect them. He remarked, that it was obviously important to make experiments in considerable number, and on a large scale, since the former secures a greater accuracy, the latter the notice of results which, from their minuteness, might otherwise escape observation. His inquiries resolved themselves into two points—the nature of magnetism—the best means of producing it. The means of overcoming the difficulty arising from the necessarily limited size of the iron and the helix, he might probably treat at a future period.

[Mr. M'Gauley then entered into a detail of his experiments.]

Mr. M'Gauley thought it would be un-

becoming in him to suggest any thing to the British Association; but he believed nothing would be more conducive to the interests of science, than that the Association should cause to be instituted a series of experiments on the galvanic battery and its charge, which would set all questions on the matter at rest for ever. Before he left this part of the subject, he thought it well to recall the attention of the Section to the nature of the power obtained by electro-magnetism. In steam, one great cause of the varying power of the engine arises from the varying leverage of the crank. Let B and B′ be positions of the extremity of the piston-rod, C′R and C′R′ corresponding positions of the crank, the leverage of the crank is measured by the perpendicular C′P and C′P′. It varies as that perpendicular. But in electro-magnetism, the force at B, say the bar traversing between the magnets, is always varying. He would not then enter into some curious results obtained by calculation on this matter.



He had been anxious to satisfy himself, by his own experiment, of the truth of the law of magnetic attraction being in the proportion of the inverse square of the distance, but abandoned the inquiry for the present, when he found that a magnet, with a seemingly appropriate bar, would lift at one-sixteenth of an inch only five pounds; though with a different bar it lifted the same weight at twelve times the distance; and that the greater the distance through which powerful attraction might be exerted, the less the lifting power appeared.

In examining the identity of electricities derived from different sources, it seemed to Mr. M'Gauley that we sometimes forget that electricity may be modified both as to quantity and intensity; and that if either be changed, or both, we cannot expect the same results. To test, therefore, the identity of any agent with electricity, we must not use those means which are the measure of, or dependent on, either quantity or intensity; for if in such experiments the electrometer or galvanometer be not affected, we only arrive at a negative conclusion—that if the agent under consideration be electricity, it differs from the ordinary electricity in quantity, intensity, or both. For though we never had been able with galvanism to cause the leaves of the electrometer to diverge, or with machine electricity to deflect the galvanometer, or with electricity to produce magnetism, or with magnetism, electricity, with electricity to produce heat, with heat, electricity,—their non-identity would by no means follow. To examine with ease and certainty the identity of any thing with electricity, we must find some property of electricity, which is not modified by, nor dependent on, quantity or intensity. We know, and chemistry furnishes us with one proof, that the elements of things may be the same as to quantity, and as to the intensity of mutual action; and yet may be productive of vastly different effects. Thus we know, that from two equal volumes of carbon and hydrogen, may be formed at least three very different substances.

The following facts seem to afford additional evidence of the perfect identity of electricity and magnetism; and that magnetism does not require, nor suppose, the circulation of electrical currents.

1st. A shock and spark are obtained by means of an electro-magnet only after battery communication is broken; for no matter how long this communication is maintained, neither shock nor spark shall be perceived. 2ndly. The shock and spark are not the effects of the battery; for to obtain a shock —(this shock he had not seen remarked by any experimentalist)—it is not necessary to form a part of the communication between the *copper* and *zinc*, but merely between the extremities of the helix, or between either extremity of the helix and the copper *or* zinc of the battery. 3rdly. The shock and spark do not arise from the magnetism of the bar included in the helix, since the more perfectly the bar is de-magnetised in breaking contact the better. Besides, it is curious that a powerful shock and brilliant spark may be obtained without any iron, and from a heap of wire thrown without any heliacal arrangement. This, Mr. M'Gauley remarked, would lead to a very simple and effective electrical apparatus, one easily managed, and always ready for use; the length and number of the coils, with a given calorimeter, has an effect on the shock and spark. Mr. M'Gauley exhibited to the Section wire coiled with the greatest accuracy, by a machine he had constructed, which was capable of covering any wire, manufacturing pianoforte strings, &c., in any length, without any care on the part of the operator, to the enormous extent, if necessary, of 7000 feet per hour. The wire which he exhibited, as several in

the Section knew, was not more perfectly manufactured than the many thousand feet he had covered lately. He thought the shock and spark might arise in this way: a current of electricity passes through the wire from copper to zinc; its inductive action on the wire ceases suddenly, by the contact with the battery being interrupted; the disturbed equilibrium of the wire is suddenly restored. The electricity of the battery seems, in passing through the helix, to acquire an augmented intensity; but from these facts it is evidently not so. 4thly. The spark and shock appear to demonstrate that currents do not circulate around the magnet. If they do, as is evident, they are capable, as we know from secondary currents, of producing a spark and shock. The helix, of itself, is capable of these effects: let the helix and the magnet act conjointly; these effects ought to be doubled; the contrary is the fact; they may be annihilated, and they ought, for the magnet, by its electrical action, retains the helix in a state of excitation. The universal —at least in other cases—law of electrical induction, if applied to magnetic phenomena, easily explains them. He did not think it by any means certain, that electrical action consists in the *transmission of a fluid*, and not the mere arrangement of particles: this idea seemed opposed by an experiment he made some time ago. He never could believe that the action of the galvanic battery consisted in the passage of electricity through the fluid from zinc to copper, and along the connecting wire from copper to zinc; he thought that the repulsion which sent the electricity through the fluid—an imperfect conductor—ought to prevent its return along the wire. He constructed a small box of wood, being a cube internally of three inches, divided it into twelve waterproof cells by well-cemented glass plates; placed in the cells six copper and six zinc plates, one in each, in the usual galvanic order; filled the cells with a charge of 1 in 50 sulphuric acid, 1 in 100 nitric acid and water, and connected the extreme plates with a delicate galvanometer, but no effect was produced, except when the copper and zinc were in the same cell, or the cells were in conducting communication; but he did not deem this experiment conclusive against his idea, since, although induction might occur from particle to particle, through an imperfectly conducting fluid, it by no means follows this inductive influence should take place through the particles of glass, since the very insulating power of glass, or other substances, may arise from the incapacity of their particles for electrical arrangement.

If it be true, that electrical effect is the arrangement, and not the transmission, of particles, he thought we might easily understand the agitation of the muscles of a frog, caused in *breaking* contact with a galvanic battery, even of a single circle; the dangerous effects to those in the neighbourhood of the discharge of lightning from cloud to cloud; and the spark and shock obtained from a quantity of wire—all of which probably arise from the same cause, and are the consequence of the same universal law.

Professor Ritchie rose to remark, that without intending to convey the least censure on the gentleman, he could not but observe, that he had been so entirely occupied with his own researches as not to have attended to any thing done by others, for there was really nothing new in this paper—and he gave examples.

Professor Stevelly remarked, that if the only objection to it were the crank and magnetic pendulum not working together, in a large machine that could be at once remedied, by what was well known in practical mechanics, a slipping coupling, as, when the steam-engine and water-wheels were made to work together, was generally done, or as in the winding part of the common clock. The great objection was the small distance through which the power worked, one-sixteenth of an inch; thus, even if a magnet could be produced that would lift 1,000 lbs., would still render the numerical value of the horse-power almost evanescent compared with the steam-engine.

ON THE CHANGE IN THE CHEMICAL CHARACTER OF MINERALS INDUCED BY GALVANISM, AND ON THE ARTIFICIAL PRODUCTION OF CRYSTALS AND MINERALS.

(From the *Times* Report of the Fifth Day's Proceedings of the Association, Friday, Aug. 26.)

Mr. Fox mentioned the fact, long known to miners, of metalliferous veins intersecting different rocks containing ore in some of these rocks, and being nearly barren, or entirely so, in others. This circumstance suggested the idea of some definite cause; and his experiments on the electrical magnetic condition of metalliferous veins, and also on the electric conditions of various ores to each other, seem to have supplied an answer, inasmuch as it was thus proved that electro-magnetism was in a state of great activity under the earth's surface, and that it was independent of mere local action between the plates of copper and the ore with which they were in contact, by the occasional substitution of plates of zinc for those of copper, producing no change in the direction of the voltaic currents. He also referred to other experiments, in which two different varieties

of copper ore, with water taken from the same mine, as the only exciting fluid, produced considerable voltaic action. The various kinds of saline matter which he had detected in water taken from different mines, and also taken from parts of the same mine, seemed to indicate another probable source of electricity; for can it now be doubted, that rocks impregnated with or holding in their minute fissures different kinds of mineral waters, must be in different electrical conditions or relations to each other? A general conclusion is, that in these fissures metalliferous deposits will be determined according to their relative electrical conditions; and that the direction of those deposits must have been influenced by the direction of the magnetic meridian. Thus we find the metallic deposits in most parts of the world having a general tendency to an E. and W., or N. E. and S. W. bearing. Mr. Fox added, that it was a curious fact, that on submitting the muriate of tin in solution to voltaic action to the negative pole of the battery, and another to the positive, a portion of the tin was determined like the copper, the former in a metallic state, and the latter in that of an oxide, showing a remarkable analogy to the relative position of tin and copper ore with respect to each other, as they are found in the mineral veins.

The Chairman said, it had been observed to them last evening, that the test of some of the highest truths which philosophy had brought to light was their simplicity. He held in his hand a blacking-pot, which Mr. Fox had bought yesterday for a penny, a little water, clay, zinc, and copper, and by these humble means he had imitated one of the most secret and wonderful processes of Nature—her mode of making metallic veins. It was with peculiar satisfaction he contemplated the valuable results of this meeting of the Association. There was also a gentleman now at his right hand, whose name he had never heard till yesterday, a man unconnected with any Society, but possessing the true spirit of a philosopher; this gentleman had made no less than 24 minerals, and even crystalline quartz. (Loud cries of "Hear.") He (Dr. Buckland) knew not how he had made them, but he pronounced them to be discoveries of the highest order; they were not made with a blacking-pot and clay, like Mr. Fox's, but the apparatus was equally humble; a bucket of water and a brickbat had sufficed to produce the wonderful effects which he would detail to them.

ARTIFICIAL CRYSTALS AND MINERALS.

Mr. Cross, of Broomfield, Somerset, then came forward, and stated that he came to Bristol to be a listener only, and with no idea he should be called upon to address a Section. He was no geologist, and but a little of a mineralogist; he had, however, devoted much of his time to electricity, and he had latterly been occupied in improvements in the voltaic power, by which he had succeeded in keeping it in full force for twelve months by water alone, rejecting acids entirely. (Cheers.) Mr. Cross then proceeded to state, that he had obtained water from a finely crystallised cave at Holway; and by the action of the voltaic battery had succeeded in producing from that water, in the course of ten days, numerous rhomboidal crystals, resembling those of the cave; in order to ascertain if light had any influence in the process, he tried it again in a dark cellar, and produced similar crystals in six days, with one-fourth of the voltaic power. He had repeated the experiments a hundred times, and always with the same results. He was fully convinced that it was possible to make even diamonds, and that at no distant period every kind of mineral would be formed by the ingenuity of man. By a variation of his experiments he had obtained grey and blue carbonate of copper, phosphate of soda, and 20 or 30 other specimens. If any members of the Association would favour him with a visit at his house, they would be received with hospitality, though in a wild and savage region on the Quantock Hills, and he should be proud to repeat his experiments in their presence. Mr. Cross sat down amidst long-continued cheering.

Professor Sedgwick said he had discovered in Mr. Cross a friend, who some years ago kindly conducted him over the Quantock Hills on the way to Taunton. The residence of that gentleman was not, as he had described it, in a wild and savage region, but seated amidst the sublime and beautiful in nature. At that time he was engaged in carrying on the most gigantic experiments, attaching voltaic lines to the trees of the forest, and conducting through them streams of lightning as large as the mast of a 74-gun ship, and even turning them through his house with the dexterity of an able charioteer. Sincerely did he congratulate the Section on what they had heard and witnessed that morning. The operations of electrical phenomena, instances of which had been detailed to them, proved that the whole world, even darkness itself, was steeped in everlasting light, the first-born of heaven. However, Mr. Cross might have hitherto concealed himself, from this time forth he must stand before the world as public property.

Professor Phillips said, the wonderful discoveries of Mr. Cross and Mr. Fox would open a field of science in which ages might be employed in exploring and imitating the phenomena of nature.

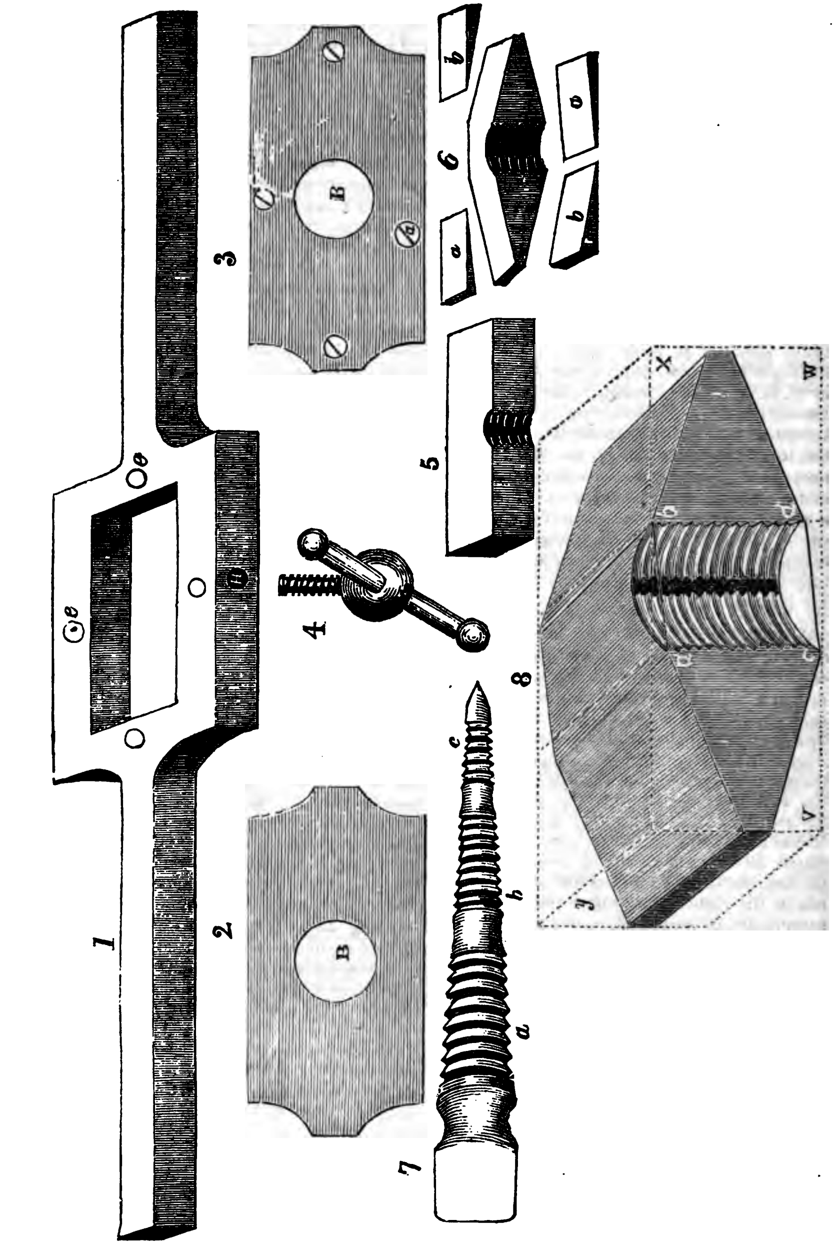


Fig. 1 is the stock for holding the dies. Fig. 2, a plate of sheet-iron, to be rivetted fast to the underside of the stock; the hole B is made for the taps to pass

through. Fig. 3 is a similar plate of thick sheet-iron, not rivetted fast, but screwed on the upper side of the stock with four screws *aaaa* in the holes *eeee* of fig. 1, so as to be taken off at pleasure. Fig. 5 is one of the dies, and fig. 6 the other, with wedges, which will be described again. Fig. 4 is a screw for moving the die (fig. 5) on between the plates as it cuts. Fig. 7 is a master-tap for cutting similar dies; and fig. 8 is a view of fig. 6, with the wedges in the proper places, as they ought to be, when you wish to cut a right-handed screw.

It will be seen that in the dies there is no rake or thread, consequently when set in between the plates, in the stock, the ends of the die, fig. 6, being previously supplied with four wedges of equal thickness, the notches or indentations in each die would be perfectly opposite and parallel to each other, and would not cut a screw, but would be in the proper position for cutting a master-tap, fig. 7, or for the master-tap when made to cut the dies. From this it will be seen, that one master-tap could be turned in the lathe with three or more indentations of different sizes, *a b c*, &c. fig. 7, which would cut as many different sized pairs of dies. Take off the plate, fig. 3, by unscrewing the screws *aa aa*, and also take the moveable die, fig. 6, out; then, instead of wedges of equal thickness, introduce those of fig. 6, and the die will have the position of fig. 8; screw the plate, fig. 3, on again, and the instrument is in its proper place for cutting a right-handed screw. If you unscrew as before, and shift the wedges, that is, put a thick one in the place a thin one occupied before, screw the plate back in its place, and you have the instrument in its proper place for cutting a left-handed screw. It will be seen by an inspection of fig. 8, that the end *a* is lowered down the thickness of one thread, and the other end *b* raised a little to make the threads or indentations on that side perfectly agree with its opposite die. The shape of the wedges are given (a thick and a thin one) so as to keep the die firm in its place between the plates, and to give it its proper inclination; the other die is made to fit and slide nicely in the stock and between the plates, so as to be moved onwards by the screw, fig. 4, as it cuts. By having another set of wedges, *so as to lower the end a, fig.* 8, one-half a thread, the other made to match its opposite die as before, a right and left-handed double-threaded screw may be cut; those wedges are very easily made and fitted.

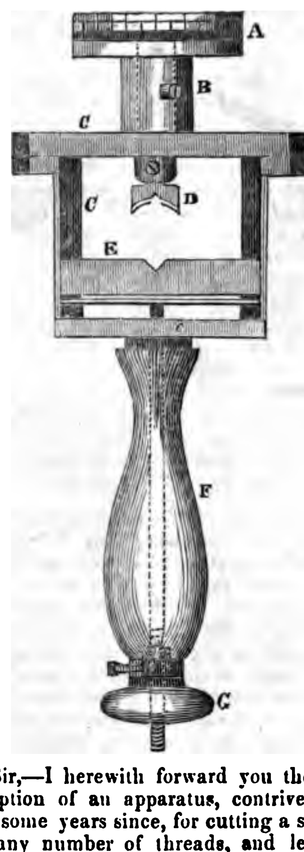
The great superiority of this method to the common dies now in use, the most indifferent observer cannot help observing; the ease and simplicity with which they are constructed, and the extent of the work performed, will no doubt render it preferable, and also insure its immediate adoption in the mechanical world.

Yours, &c.

JAMES TRACEY.

Pembroke, May 2, 1836.

HEINEKEN'S SCREW-CUTTER.



Sir,—I herewith forward you the description of an apparatus, contrived by me some years since, for cutting a screw of any number of threads, and left or right-handed. The principle upon which

the screw is formed is the same as that which was employed by the late Mr. Allan for cutting a true screw for his dividing-engine; but the machine now described will perform what his would not, viz. cut a screw of any length.

Description of a Machine for Cutting correct Screws.

CCCC is a frame of metal, between the bevelled edges of which a piece of box-wood E slides, in which is an angular notch for the reception of the cylinder upon which the screw is to be cut. The box-wood is used in order that as soon as a thread is cut upon the cylinder a similar one may be formed by its action upon the wood, and by this means ensure all the succeeding threads to be repetitions of the primary one. Under this piece of wood a plate of brass is fastened to the end of a screw, which passes through the handle F. The nut G is also tapped, and, being confined to its situation by a small screw (the point of which enters a groove formed round the nut), will when turned round force the brass plate and block of wood up towards the cutter D. A is a divided micrometer-head, the lower half of which is connected with the tube B. This tube is again fastened into the centre of the upper plate of the frame C. The upper half of the divided head A has in its centre a cylindric piece of metal accurately fitting the tube before-mentioned—confined in its place by a small screw at the side of the tube B, and formed so as to receive at its extremity the cutter D, which cutter is also firmly fixed by a small side-screw.

In order to use the machine it is necessary, in the first place, to fix the cutter D at right angles to the axis of the cylinder upon which the screw is to be cut. For this purpose, let there be prepared a cylinder of steel, hardened, round which is turned an angular groove; release the small screw at the side of the tube B, so that the divided head A and cutter D attached to it shall be free to move round. Now insert the above-mentioned cylinder of steel in the notch of the box-wood E, so that the groove in the steel cylinder may receive the cutter D. Gently force it up against the cutter by turning the nut at the end of the handle. Now turn round the steel cylinder, and it will place the cutter at right angles to the groove in the wood E. This being done, in order to cut a screw with any given number of threads per inch, calculate trigonometrically what angle the thread must form with the axis of the required screw. Set then the cutter to this angle by the graduations on the upper half of the head A, and fix it by screwing up the screw at the side of the tube B. Having the cylinder upon which the screw is to be cut turned true in every respect, place it in the notch of the piece of wood E. Screw it up (slightly at first) against the cutter by means of the nut at the end of the handle F, and turn the cylinder cautiously round; the screw will then be formed upon it, and by degrees may be cut to any required depth. For a left-handed screw the cutter must, of course, be set in the contrary direction to that required for a right-handed one; and I should also state, that the cylinder upon which the screw is to be cut should be inserted about an inch or so into the machine at the commencement of the operation, that it may have a good bearing.

I am, Sir, yours respectfully,

N. S. HEINEKEN.

Sidmouth, April 26, 1836.

IMPROVED HANDLE FOR STREET WATER-POSTS.

Sir,—Within the last twelve months the New River Company have adopted the commendable precaution of preventing a needless waste of their water, by

locking up the water-posts throughout the metropolis; but they have not been at all happy in the plans they have resorted to for this purpose. In the first place, a ring was fastened on the octagonal at the top of the post, and a chain brought down from it to a staple fixed at the side, and secured by a padlock. This was, for many reasons, a very objectionable arrangement, and has been recently superseded by another modification, unfortunately not much better. In the present contrivance the octagonal ring is attached to a long arm which terminates in a chain-link, and eye to embrace the staple. When water is required, the padlock has to be opened, the ring, arm, &c. taken off, and a key placed on the octagon pin, when the cock may be turned.

Annexed is a rough sketch of a contrivance, that I am inclined to think would be much more convenient, and far more advantageous, than any of those that have been hitherto employed. *ab* is a curved iron arm or lever permanently fixed to the plug-head of the cock, and hinged at *a*, with an eye to embrace the staple at *b*; the padlock making all fast. When water is required, the padlock being removed, the arm is raised to the position shown by the dotted lines, and forms of itself a handle, by which the water may easily be turned off or on at pleasure. By an arrangement of this kind, no key, except that to the padlock, is required to be carried by firemen and others who have occasion to use the water, and a cock so secured may be opened in less than half the time taken up by the three-fold operation at present required.

The foregoing sketch exhibits the mode of applying this principle to posts at present standing; but in any new castings it might be applied in a more elegant manner.

I remain, Sir, yours respectfully,

Wm. Baddeley.

London, August 22, 1836.

DR. M'CORMAC'S ROTARY PRINTING-MACHINE.

Sir,—While looking over your valuable journal for July, I find at p. 271 the announcement of a patent rotary printing-machine. Such a one occurred to me several years ago; and about five years since, I had a small machine constructed of three cylinders, upon one of which I imposed the type, and upon another some woollen cloth; the remaining one was for the purpose of applying the ink. I found it to answer very well for illustrating the principle of rotary printing; and a correct impression was given with any degree of speed by turning a crank. I employed both moveable type and bent stereotype plates. Upon visiting London, however, I found the latter in use; but no one with whom I came in contact seemed to have conceived the idea of the former, nor was it any where in operation. My discovery was communicated to a number of friends here; and in London, I mentioned it to Dr. Birkbeck, Dr. Bowring, Mr. Spottiswoode, Mr. Bramah, Mr. Clowes, Mr. Morgan, and others, and I directed a respectable firm of solicitors to take the preliminary steps for securing a patent right. This, however, I declined prosecuting to the close, partly on the score of the expense, and partly from the interference of professional pursuits. When I mentioned my proposed method to Dr. Bowring, he said that it had been long in use; and was only convinced of his error by inspecting, along with me, the improved printing-machine at Mr. Hansard's, Paternoster-row. Mr. Clowes, while he accompanied me through his establishment near Stamford-street, admitted the applicability of my method, but contended that the improved machine then in use was adequate to meet every demand.

It is quite obvious, that an arrangement whereby a revolving cylinder is covered with type must produce results very much superior even to those of the very best engines now manufactured. The establishment of the *Times* newspaper has been noted for its efficiency, yet a rotary-machine would as much excel that which is employed therein, as the latter surpasses those ordinarily in use. This will be evident if we consider, first, that the area of the form of type employed in the existing improved machine does not perhaps exceed a fourth of that of the cylinder by which the paper to be printed is applied to the surface of the form; second, that the cylinder in question, in place of continuously revolving, has its motion reversed,* in order to

* Our correspondent is in error here; the cylinders revolve continuously, but the bed upon which the form of type is laid reciprocates.—Ed. M. M.

permit the form to resume its place, by which the area of the latter is virtually reduced to one-sixth of that of the cylinder; and, third, that the existing improved machine only admits of a limited degree of velocity; whereas that of the machine which I propose is restricted in this respect only by the capacity of the materials, and an equable rotary motion would permit considerable rapidity—but if we only say six times that of the ordinary improved machine, it will, if added to the increased area, produce an increase of rapidity virtually twelve times greater. It is obvious, however, that a duplicate engine might be so arranged that both sides of the sheet might be printed almost at the same instant; hence the ultimate rapidity will be about twenty-four times that of the existing improved machine. As the improved paper-making machines can turn out sheets of any required length, such would probably answer better in the proposed rotary printing-machine than the small sheets now in use.

The bent stereotype-plate I found in use when I went to London, but I was previously ignorant of the fact. One would have supposed that the utility of extending the plates over the whole cylinder would have been obvious, but in Mr. Clowes' machines the plates covered but a small portion of it indeed; and the motion, in place of being a continuously revolving one, alternated backward and forward, by which half the area of the cylinder, or, in other words, half the time was lost. It might have also been thought that the superposition of stereotype-plates on a cylinder might have led to the superposition of moveable types also; but it was not so, at least it was no where in use, nor did I ever hear of it before the conception arose in my own mind. The method by which it occurred to me that this might be realised was simple enough; the type must be wedge-shaped or pointed, or the spaces which separate them must be so. I chose the latter in the rude machine which I had constructed, for the simple reason that I had no means at hand of procuring wedge-shaped type, or for having them cast. It is quite clear that no other contrivance will avail to secure the necessary parallelism of type when applied to the surface of a cylinder. I proposed to *secure the type* together by a small iron chase, with four sides, two of which were suitably curved and applied to the cylinder by means of screws. The size of the chase was to be that of the half sheet; and the types were to be duly secured in it by lateral screws. In this manner I locked together, and applied to my little cylinder, an advertisement casually taken from a printing-office, which sufficed, with my limited mechanical means, to show the practicability of the principle of rotary-printing. The chase, with the contained type and lateral screws, I showed to several individuals in London, and finally left it at the National Repository, Charing Cross.

I remain, Sir,
Your very obedient servant,
HENRY M'CORMAC, M.D.

Belfast, August 24, 1836.

LUBRICATION BY WATER.

Sir,—I perceive in the report of the *Times* of the proceedings of the scientific meeting at Bristol, that Dr. Lardner suggests placing watering-pots before the wheels of a train of railway-carriages to reduce the friction. The fact of a train running lighter on a wet day is well known to every engine-driver; and it occurred to me to avail myself of the water leaking from the boiler or tender, passing it, in the first instance, into my ash-pan (described in No. 680), from which the excess drops in a small jet behind the engine-wheels; thus the engine travels over the dry, and the tender and train over the wetted part of the rail. In the event of the boiler being so tight that the leakage would be insufficient, two small tubes, with regulating cocks, should pass from the tender or cistern, and discharge a small jet on the rails as the train passes along. I shall feel obliged by your insertion of this letter in your earliest Number in order to advance my title to the priority of this useful adaptation of what would be otherwise lost water.

I remain, Sir,
Your obedient servant,
W. J. CURTIS.

Deptford, August 29, 1836.

MR. MACKINTOSH'S ELECTRICAL THEORY OF THE UNIVERSE.

Sir,—Mr. Mackintosh informs me in his last article (No. 681) that I labour under a mistake with regard to his elec-

trical theory of the universe. It is, he says, "no where stated to be in accordance with Kepler's laws," &c. I shall quote the passage I alluded to, which is given in No. 645, p. 233:—

"We have no data whatever which would enable us even to attempt to fix the time occupied in accomplishing these vast operations of nature; each specific change in bodies of such immense magnitude must require periods of vast duration—compared with which the age of human records is but as one day. We are assured by experiment that the attractive and repulsive forces of electricity follow the same law as to its intensity, that is, the inverse law of the squares of the distances. Let this *be compared with the laws of Kepler*, and we think that the conclusion cannot be resisted, that the motion and distances of the planets are regulated and determined by this powerful and all-pervading agent."

I certainly thought, and I think so still, that Mr. Mackintosh meant to infer, that the effect produced by the agency of electricity would produce a similar result in the motion of the planets to that which is said to be produced by Kepler's laws. Mr. Mackintosh, however, now thinks proper to deny this. But Mr. Mackintosh must be aware that Newton has rigidly demonstrated the truths of Kepler's laws, and that they form three strong pillars in support of the Newtonian system of the universe; so that if the electrical theory is at variance with Kepler's laws, it is equally so with the Newtonian system. Then, Mr. Mackintosh, on this head we understand one another.

Again, Mr. Mackintosh informs me, that if I will examine his system more attentively, I will perceive, "that so far from the momentum of the planets being extinguished, they are supposed to be accelerated; because it is assumed they move in spiral orbits, which (the orbits being elliptic) is the same in effect as if they were rolled down an undulatory inclined plane." I beg to assure Mr. Mackintosh that I have duly considered all this, which is deducible from the equation $dv^2 = DV^2$, that is, if D and V^2 be constant, and d a variable diminishing quantity, v^2 and $\therefore v$ will continually increase. But what becomes of the momentum when the planet comes in collision with the sun? It will produce an increased velocity in the sun, and both will then move on with the same velocity. A few sparks perhaps will fly off from the sun after the collision, which will afterwards be manufactured into so many comets, and they will in proper time be converted into regular planets, taking their proper places in the system in rear of the Herschel planet. Now here I cannot help remarking, that Mr. Mackintosh's theory has some resemblance to what is commonly styled the fanciful theory of Buffon.

Mr. Mackintosh seems to think that his theory derives great support from the established fact of the moon's secular acceleration. That the motion of the moon for some thousand years back has been continually accelerated, is an undeniable fact; but I am afraid it will add little in support of the electrical theory. Halley, by comparing the ancient Chaldean observations with those of the Alexandrian, and those of the Alexandrian with the Arabian, and, lastly, the Arabian with those of modern times, discovered that the moon's mean motion was a little accelerated, amounting to eleven seconds in a hundred years; and how to account for this perplexing fact upon the principles of universal gravitation, resisted the united efforts of some of the greatest astronomers. La Place at last discovered the cause of this seeming anomaly in a dissertation he read to the Royal Academy of Science in 1785. He there shows "that the acceleration of the moon's mean motion necessarily arises from a small change in the eccentricity of the earth's orbit round the sun, which is now diminishing, and will continue to diminish for many centuries by the mutual gravitation of the planets." He determined the diminution in a century to be 11·135 seconds; he had previously determined that a like anomaly took place in the satellites of Jupiter, "and as the motions of these bodies are so rapid, in the course of a few years many synodical periods are accomplished, in which the perturbations, thus arising from their mutual actions, return again in the same order." And such synodical periods have been since verified by actual observations. La Place's great rival, Lagrange, arrived at a similar result, and demonstrated that all these small perturbations go through all their varieties, swelling to a maximum and then diminishing to 0. These great astronomers have also de-

monstrated, that the primary planets have no secular equations; that the axis major of all their orbits will for ever remain the same in magnitude; and that all the perturbations that are observed or can exist in this system are periodical, and are compensated in opposite points of every period, and that the mean distances and mean periods of rotation round their respective orbits are for ever the same. The precision of the equinoxes was a complete mystery to Copernicus, Tycho Brahe, and Kepler. But the penetrating eye of Newton soon discovered that it was one of the perturbations that tended to give an eternal stability to the system. La Place has demonstrated that gravity darts its influence more than fifty million times faster than light, and "sets for ever at rest the various speculative attempts to explain the cause of attraction by the agency of certain mechanical *intermedia*, and proves it to be a primordeal and ultimate principle ordained by the wisdom of the Supreme Architect."

But I will ask Mr. Mackintosh, is he certain of the existence of an electrical fluid? He must know that we ought "never to admit as the cause of a phenomenon any thing of which we do not know the existence."

Sir John Leslie, in treating on the subject of electricity, concludes with the following remarkable observations:—

"It must indeed be confessed, that after all the progress which electricity and its younger branch, galvanism, have made, the hypotheses commonly received are exceedingly vague and unphilosophical." * * "In cultivating these attractive sciences, experimenters would seem to satisfy themselves with the exercise of a lower and humbler species of reasoning." * * "It is rather amusing to observe the complacency with which some ingenious persons describe the play and vagaries of an *electrical current whose existence was never proved*." * * "We are acquainted only with electric attraction and repulsion, and with the transmission of electrical influence." * * "All beyond these elementary principles rests on hasty conjecture." * * "Instead of adopting one or two fluids, it were safer to suspend the assumption of any." * * "We can perceive no distinctive marks of the operation of a fluid which is often confounded with the mere *luminous tract occasioned* by the particles of *light disengaged from* the substance of the conductor; the colour of emission being modified by the peculiar character and intensity of the retaining force."

I am, Sir, yours, &c.

KINCLAVEN.

Aug. 29, 1836.

P.S.—I shall reply very soon to the article of my old acquaintance, Ursa Major; at present I shall only say, "that he should not whistle his favourite airs when he wishes to remain undiscovered."

THE TIDES.

Sir,—Having seen in your 680th Number a letter bearing the title of a "New Theory of the Tides," and considering that from M'Laurin downward the same principles have been more or less elaborately explained, I confess that the novelty does not discover itself to me; at the same time it must be admitted, that one may invent what is not new. In furtherance of the very general desire which appears to exist of coming to a satisfactory elucidation of *the apparently uncaused tide*, viz. that on the remoter hemisphere of the earth during the conjunction, &c. of the sun and moon, I will enter upon your appropriate pages, with your leave, the mention of another possible, not to say necessary, element, as greatly auxiliary to the determination of the question. This is a body which recedes beyond, or approaches within, the average distance of our atmophere's extension from the surface of the earth, according to its position with respect to those luminaries; for, being an encompassing sphere to the air, as that diaphanous fluid is to this globe, the confluence of its particles will be similar to the confluence of the tidal air, by which it is inflated and separated from the terraqueous surface.

The approximation of this orb—the sky will therefore always take place where the least direct effect from the sun and moon leaves for a time a shallow atmosphere between it and inferior ocean; the tide whereof is raised by the tendency of bulk towards bulk in the passing of the fluent masses; which will resolve the difficult case, to even Newtonian mathematicians, *that* of the remoter tide *exceeding* sometimes the height of the illumined tide. Should it be asked, how

is the existence of such a capacious shell of translucent matter discerned or proved? —its colour is distinctly azure, varying according to the presence and position of the sun, and by its tone of increased depth towards the zenith, where the air is of least gauge to a spectator, it is manifest that atmosphere, a transparent firmament, is interposed to conduct, not originate;—if to qualify the hues by extraneous floating particles of moisture, rather than by a property at variance with its fitness as medium of all rays to recipient vision. Its form is necessarily such as the atmosphere's which it bounds, and its gyration probably very rapid. Other benefits resulting from so stupendous an appendage to this planet may be inferred; amongst which, a similar protection from solar power to that which shining Venus analogously enjoys may not be overlooked.

Some have justified the confounding of air and sky, in assuming that the blue dome is an appearance which results from the *darkness* of outward space as *seen* through the enlightened atmosphere; but the privation of light cannot be reflected, and if we regard the mountain sky and the embosomed lake, the eye is equally delighted with the cerulean tint,—not shocked by a refulgent blaze of brightness (white light unmodified) beaten back to us from the serene expanded mirror.

I am, Sir,
Yours respectfully,
W. F. G. WALDRON.

Upper Holloway, Aug. 23, 1836.

BALLOONS AS NOW CONSTRUCTED.

Balloons are bags of a spherical or spheroidal form, made of gores of silk, coated with a varnish which renders it impervious to air. The best for this purpose is made of caoutchouc. Each of the gores is prolonged into a rectangular strip, and these, when sewed together, form a long cylindric tube. The air having been forced from the balloon by compressing it, this tube is tied to that which is adapted to the inverted barrel, the counterpoise being removed, and the pressure, if necessary, aided by loading the gasometer with weights, the contained gas, with that which is subsequently generated in the barrels, is forced into the balloon until it is completely inflated.

Hydrogen gas having not more than $\frac{1}{10}$th of the density of atmospheric air, the joint weight of a large balloon and the gas which it contains, is far less than an equal bulk of atmospheric air; and it will not only rise itself, but will carry with it a considerable additional weight. In order to attach a weight to it, a net-work is formed of cords in such manner as to embrace the upper half of the inflated balloon, and from its equator, straight cords proceed, to which a car is tied. The balloon must be of such size as not only to carry up the persons who are to mount, with their necessary equipment, but also a considerable quantity of ballast. This is in the form of sand tied up in canvas bags. The object of this combined with a valve in the top of the balloon, is to enable the aeronaut to ascend or descend at pleasure, as long as the ballast and the gas in the balloon are not wholly expended.

This valve is placed on the top of the balloon, and is thus constructed: the gores, instead of meeting in a point, are united upon a ring of whalebone, and thus leave a circular opening; to this a circular shutter of silk, spread upon a similar ring, is adapted by a hinge; two cords proceed from this, over the net-work, in opposite directions to the car; by one of these the valve can be opened, and by the other, closed.

Then the balloon is released by cutting cords which held it down, the tube which proceeds from its lower point, and is long enough to reach the car, is left open, in order that the gas in the balloon may be at liberty to escape as it tends to expand itself, in consequence of its reaching regions in the atmosphere less dense than those nearer the surface of the earth. Although the escape of this gas renders the balloon somewhat lighter, it must finally reach a position where its weight is exactly the same as that of an equal bulk of the surrounding air, and must cease to ascend. A farther height may be attained by throwing out ballast. This is done by opening the bags in which it is contained.

When it is wished to descend, the valve in the top of the balloon is opened until the collapse caused by the escape of the gas renders the balloon heavier than an equal bulk of the surrounding medium, and the force which causes the descent will be an increasing one, as the collapse is increased by the increasing pressure of the denser air. It may therefore be necessary to check it by the discharge of ballast, and by doing this in sufficient quantity, the balloon may be rendered stationary or caused to ascend again. In the latter case it is no longer necessary to allow the gas to escape by the tube beneath, which is therefore closed by knotting it.

A balloon has no other capacity of being

directed except in ascent and descent. No power has yet been discovered, which can be called into action, of sufficient intensity to propel a balloon through the air, and make it move in a direction contrary to the currents of wind, and which shall be produced by apparatus sufficiently light to be carried up by a balloon.—*Professor Renwick's Lectures.*

NOTES AND NOTICES.

Writings of Roger Bacon.—The Academie des Sciences Morales et Politiques was on Saturday informed by M. Cousin, that he had just discovered some manuscripts which are important to scholastic and philosophic history. They are writings of Roger Bacon, the celebrated philosopher of the 13th century. Roger Bacon was an Englishman by birth, but passed nearly the whole of his life in France. He became a Franciscan friar, and lived a long time in the convent of the Cordeliers, to which he was confined by order of the General of the Franciscans. This, notwithstanding the silence of Montfaucon and the other bibliographs, induced M. Cousin to believe that there must be manuscripts by Roger Bacon still existing in France. He began by making searches at Douai and St. Omer, where there were formerly English Colleges. These searches have been successful. The only work of Roger Bacon hitherto known is his first letter to Pope Clement IV., which Bacon entitled *Opus Majus.* Clement IV., who protected Bacon, desired that he would give him an exposition of the state of science in the 13th century. Bacon, receiving no answer to his first letter, addressed a new work to the same Pope, under the title of *Opus Minus.* The second letter also remaining unanswered, Bacon remodelled his work, and addressed a third letter to the Pope, which he called *Opus Tertium.* The *Opus Majus* was published at London in 1733. England possesses a manuscript of the *Opus Minus*, and it has hitherto been believed that there was no other in existence; but M. Cousin has discovered at Douai a manuscript containing a considerable fragment of it. This work, in his opinion, is of no great importance. It is not, however, the same with the *Opus Tertium*, which may be considered as the last words of Roger Bacon; a manuscript of which has been discovered by M. Cousin, and is the only copy to be found in France. He has, besides, recently discovered at Amiens another manuscript by Bacon, the existence of which had never been suspected. It contains questions on the physics and metaphysics of Aristotle. These three manuscripts, of which M. Cousin is preparing a memorial, will throw a light upon the history of scholastic philosophy, and inform us whether or not Roger Bacon was really, as has been asserted, the inventor of the telescope, the microscope, and gunpowder. This is a question which, for want of authentic documents, it has hitherto been impossible to solve.—*French Paper.*

Porcelain Colours.—The pink colour which ornaments the English porcelain has been hitherto unknown in France, and when required in that country was always bought here. M. Mallagutti, of the manufactory of Sevres, has analysed this colour till he is now able to compose it. In the course of his experiments he discovered another colour similar to crimson lake, which is much more durable than any derived from the animal kingdom, and which may be advantageously employed in oil-painting.

The Meteorological Society of London is about to be revived, after having lain dormant for several years, not from the lack of pecuniary means to carry into effect the objects of the Society (as nearly *100l.* have been invested in the Three per Cent. Consols), but from a want of that union of purpose and harmony of operation which ought to characterise every public body. A portion of the above fund is to be devoted to two prizes of, *50l.* and *25l.* respectively, for the first and second essays on a given meteorological subject. A meeting of the present members will be called, by public advertisement, in a very short time, when gentlemen friendly to meteorological science will do well to become members without delay. Dr. Birkbeck is the President of the Society; Dr. Clutterbuck, Professor Daniells (King's College), Dr. Shearman, and many other scientific men, are among the members.—*From a Correspondent.*

Carriage-Speed Regulator.—An ingenious plan has been formed to stop waggons, coaches, and other carriages, which may have been run away with by horses. It is simply to apply the governor used in steam-engines, so as to bring the break into operation.

Botanical Society of London.—A number of botanists, amateurs, &c. have recently held several meetings at the Crown and Anchor Tavern, Strand, for the purpose of forming themselves into a Society, bearing the above title. One striking feature of this Society is, that ladies will be admitted members; this we think highly deserving of commendation, as many ladies are not only excellent botanists, but they can generally devote a considerable portion of time daily to practical botany. Among the leading objects the Society propose are the following:—The advancement of botanical science in general; the particular cultivation of descriptive and systematic botany; the formation of a library, herbarium, and museum; the reading of original papers, extracts, and translations; the exchange of specimens with other societies or individual collectors; and every other available means that may promote the objects of the Society. It is further intended that the Society shall consist of the following classes of members; viz. resident, corresponding, honorary, and life members. We are glad to find, among the mighty mass of bricks and mortar, ladies and gentlemen so ardently devoted to so healthy and endearing a pursuit as botany. We shall be happy to hear of their complete success.

Wire for Musical Instruments. — Sir, Admiring much the tones of the newly-invented musical instrument, the Seraphine, I endeavoured to construct one, and have succeeded in accomplishing the task; but find great disappointment in its not keeping in tune. In making the tongues, or vibrators, I have tried both brass and German silver; the latter producing the finest tones, but subject to the before-named defect. If any of your intelligent correspondents could point out the *best metal* to articulate quick, and stand in tune, and sufficiently flexible as not to be liable to break with the pressure of air during its vibration, and also where it can be purchased, he would much oblige, A MECHANIC. August 30, 1836.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

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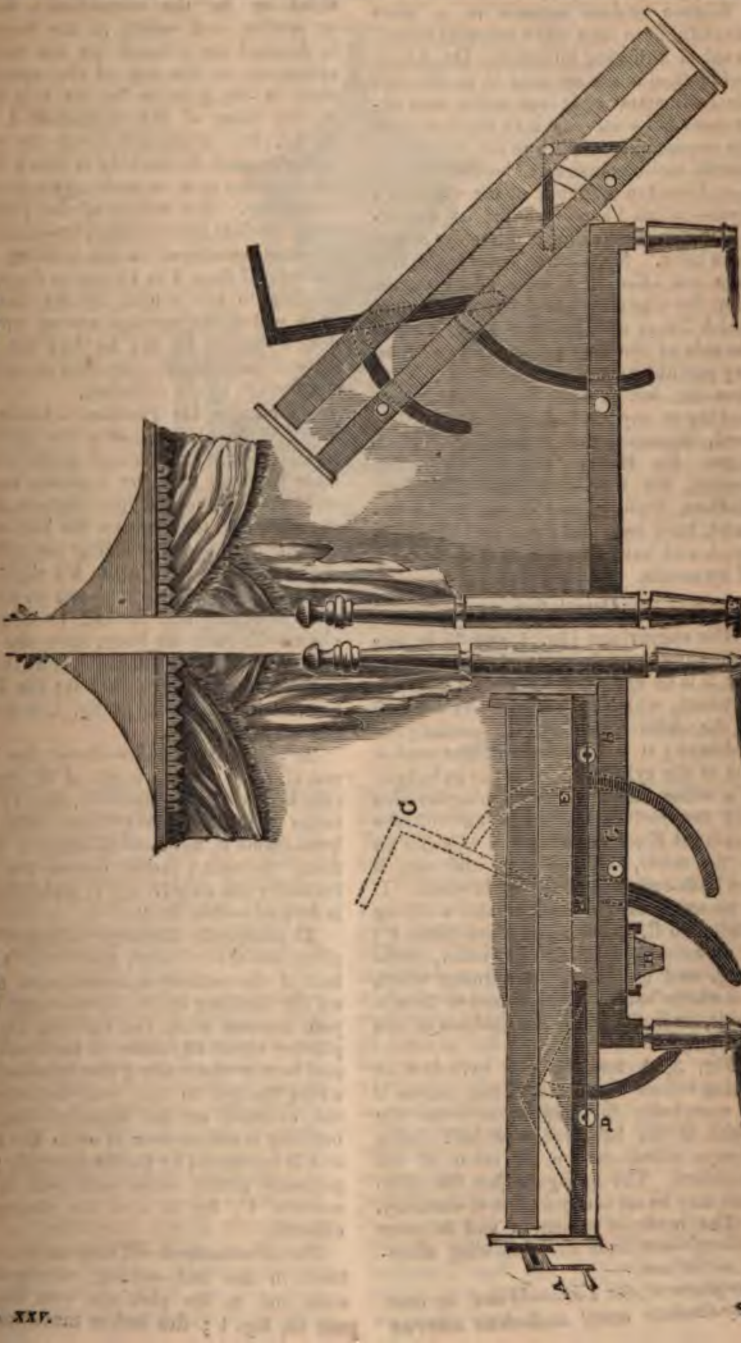


Fig. 1. CHERRY'S PATENT INVALID'S BEDSTEAD. Fig. 2.

CHERRY'S PATENT INVALID'S BEDSTEAD.

Science seldom appears in a more beautiful form than when exerting herself in aid of suffering humanity. Dr. Arnott has soothed many an hour of agony with his hydrostatic bed; but there were objections to its use—such as its dampness, the impossibility of putting the patient in a merely inclined instead of horizontal position, from the tendency of the water to a level—which have prevented its use becoming so general as it otherwise would have done. Mr. Cherry's invention, if it does not afford that ease which results from the elasticity and fluidity of water, which bears equally upon every part of the side of the incumbent, and not upon any protuberances, such as the hip-joint, shoulder, &c. as must be the case where sacking or any kind of substantial bed is used, possesses many peculiar advantages. Sir Henry Halford, Sir Astley Cooper, Sir Benjamin Brodie, Messrs. Guthrie, Stanley, and Keate, we understand, have seen and examined the bedstead, and have certified most favourably of its merits.

Description.

The engravings (fig. 1 and 2) in our front page are side-views of the bedstead. Fig. 3 is an end-view. Fig. 1, A is a key or winch, which fits on to the axle-heads of the different pulleys for working the bedstead; it is here seen at the end of one of the cylinders. B is the axle-head of a roller, round which webbing is rolled and fastened at the lower end of the quadrant E; by turning the webbing on to the roller, the quadrant, and with it the back-rest C is raised or lowered. D is an axle-head, with roller and webbing similar to B, to raise the knee-frame F; G an axle-head attached to roller, webbing, and quadrant, by turning which the whole bed-frame is raised to form a chair, as in fig. 2; H the position of the bed-pan.

Fig. 3, A and B, are cylinders or spring rollers, upon which the canvas C is stretched; the canvas is twice the width of the bedstead, one half being always rolled on one or other of the cylinders. The springs within the cylinders may be set to any degree of elasticity.

The mode of operation will be more *distinctly* seen from the following directions for its use:—

To prepare it for Use.—Wind up one of the cylinders until sufficient canvas is on it to allow full play to the springs acted on by the incumbent's weight or motion, and which in the bedstead is denoted by a mark on the sacking appearing on the top of the cylinder; then fix the cylinder by the bolt (seen at the sides of the cylinders A and B, fig. 3); afterwards wind the other cylinder until the sacking is drawn tight: the bed may now be made up on it in the usual way. The weight of the patient's body revolves the cylinders inwards, and he sinks enveloped in the bedding to a concave of from 3 to 12 inches deep, according to his weight, or the strength with which the springs are set up (see dotted lines C, fig. 3); he thus lies in a state of undulation, supported entirely by the springs in the cylinders.

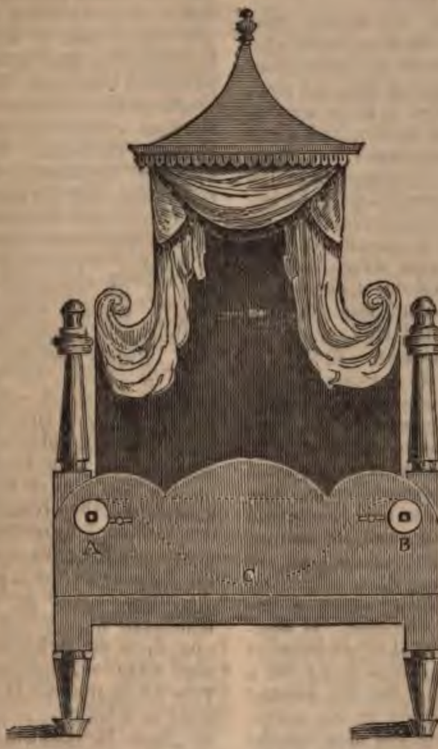
To change the Position.—Apply the key (A, fig. 1) to either of the cylinders (A and B, fig. 3), and press it whilst you release the bolt, then let it gently revolve until the body rests on the platform under the sacking; then release the bolt of the other cylinder—by revolving the cylinder B you place the patient on his right side —by the other A, he is placed on his left —by revolving still further, he is on his chest. To raise his body, turn the axle B, fig. 1, to the right, till it is at the required elevation, and bolt it; the knees are raised by the axle D, fig. 1, turned to the left and bolted.

To form the Chair.—Raise the bed-rest C, fig. 1, to an angle of 30 degrees (marked on the quadrant E, fig. 1), this forms the chair-back; then raise the knee-frame F, fig. 1, to 45 degrees, which forms the seat; lastly, elevate the bed-frame by the axle G, fig. 1, and the chair is formed.—See fig. 2.

To change the Bedding.—Place a table alongside the cylinder, upon which one-half of the sacking is rolled, and make up the bedding on it, intersecting it as you proceed with the bedding in use, placing about 12 inches of the fresh bed and bottom sheet along the cylinder, and under the bed in use; you then revolve the cylinder on the opposite side, the bedding is drawn over it on to the floor, and is succeeded by the fresh supply; the patiently gently turns once over in the concave C, fig. 3, and the change is effected.

For Evacuations.—There are two apertures in the bed-sacking corresponding with one in the platform over the bed-pan H, fig. 1; the bed or mattrass is also

Fig. 3.



perforated to correspond, (the aperture being usually closed by a cushion); the pan slides under the bedstead, and the patient is gently placed (by the cylinder) on his side, and the cushion removed—this effects a direct opening to the pan, and the patient is replaced on his back.

The advantages of the bedstead are stated to be the following:—

1st. By it a patient may be elevated at the shoulders to any pitch desired. 2nd. The knees may be raised to assist in sustaining the weight of the body. 3rd. The whole frame of the bedstead may be raised so as to assume a perfect chair-form, when the apparatus for raising the knees becomes the seat of the chair. 4th. The trouble and evils attendant on the introduction of a bed-pan are obviated. 5th. Bed-ridden and weakly patients are turned from side to side, as may be wished; or on the face when operations and dressings on the back are necessary. And, lastly, an entire change of bedding is effected in one minute; and above all things be it observed, that every one of these operations of raising and lowering, turning and changing, are made without so much as touching the patient, and with an ease and a readiness calculated to soothe pain, instead of annoying or irritating the sufferer. The sacking of the bedstead being stretched upon spring rollers, imparts a most agreeable elasticity of action at every motion of the patient; while the operations of reading and writing, and the administering of food and medicine, are, by the various movements of which the bedstead is susceptible, greatly facilitated.

We understand that Mr. Cherry, the meritorious inventor, died soon after securing the patent. We hope that his widow and children will reap the benefit of his ingenuity. A model, we are informed, may be seen at the Adelaide Gallery; and the bedstead itself, by application to Mr. W. C. Lewis, 23, Leicester-square.

MACKINTOSH'S ELECTRICAL THEORY OF THE UNIVERSE.

Sir,—There is an old saying, that "there are none so blind as those who will not see." Kinclaven first infers from the passage he has quoted that the electrical theory is asserted to be in accordance with the laws of Kepler, and when reminded that no statement has been made with respect to its agreement or disagreement with any law whatever, he betakes himself to the other alternative, and infers that it is not in accordance with those laws; and concludes his observations on that head by saying, "if the electrical theory is at variance with Kepler's laws, it is equally so with the Newtonian system." Perhaps Kinclaven will find in the end that it is not at variance with either the one or the other; that the electrical theory is an extension of the principle of universal gravitation; and that, with some qualifications, it is in perfect accordance with the laws of Kepler. The statements which have been made are general and indefinite, and, of course, under such circumstances those who are predisposed to cavil may draw inferences, so as to make the theory agree or disagree with any law whatever. If Kinclaven will not understand, we must at least endeavour to put the matter in a shape sufficiently plain that the general reader may not be misled by his misrepresentations. "From the most careful analysis of the phenomena of electric attraction, it has been deduced that the exact law of this force is *the same as that of gravitation*, namely, that its intensity is inversely as the square of the distance." —"The mode in which the electricity imparted to a conducting body, or to a system of conductors, is distributed among its different parts is in exact conformity to the results of this law, as deduced by mathematical investigation." Now, if we find that the ordinary phenomena ascribed to gravitation may be referred with equal propriety to electrical attraction, then either hypothesis may be adopted indifferently. If we find particular instances in which the phenomena are better explained upon electrical principles, we are induced to give the preference to the electrical hypothesis in those instances, without perhaps rejecting gravitation altogether. But if we find, upon examining the phenomena more closely, some instances which cannot be explained upon the principles of universal gravitation, but which may upon electrical principles, then we are compelled to reject gravitation, and to adopt the electrical hypothesis, at least so far as respects those particular instances. In all cases if both forces follow the same law, the demonstrations cannot be affected by merely changing the terms. But if we adopt the electrical hypothesis, this includes the supposition that the earth is charged with electricity, and this brings us to another point in Kinclaven's letter.

He says, "I will ask Mr. M. is he certain of the existence of an electrical fluid." We are bound to suppose that Kinclaven is serious in asking this question. Bishop Berkeley denied the existence of matter; in doing which his seriousness has not been questioned, although some doubts have been entertained with respect to his sanity. However, let us not misrepresent Kinclaven; he has not denied the existence of an electric fluid, although we might draw that inference with quite as much propriety as has been done on his part with respect to the laws of Kepler agreeing or disagreeing with the electrical theory. Kinclaven having put the interrogative cautiously, brings forward Sir John Leslie with some "remarkable observations." This designation is quite appropriate. It must be allowed that the observations of Sir John are somewhat remarkable. It is also remarkable and worthy of observation, that they happen to be published in a Number of the *Mechanics' Magazine* which contains their complete refutation by the able and, we may add, wonderful results (although they are not new) of the experiments of Messrs. Fox and Cross, as detailed at the Bristol meeting of the British Association. Well might Professor Sedgwick exclaim, that "the operations of electrical phenomena proved that the whole world, even darkness itself, was steeped in everlasting light, the first-born of Heaven." Whatever Kinclaven may think about the existence or non-existence of an electric fluid, he will not be hardy enough to deny that there are certain effects which have been ascribed to the action of an electric fluid, and which cannot be explained on any other hypothesis. Although Kinclaven is attacking the electrical theory with more asperity than to me appears needful, I hope he will never have the

existence of the fluid proved to him by the *argumentum ad hominum* from electricity itself. Kinclaven ought to know, that putting interrogations is a dangerous mode of discussing a question, because the respondent sometimes lays claim to the same prerogative. Can Kinclaven give a definition of gravitation *per se*, excluding the idea of matter?

Kinclaven says, "La Place has demonstrated that gravity darts its influence more than fifty million times faster than light; and sets for ever at rest the various speculative attempts to explain the cause of attraction by the agency of certain mechanical *intermedia*, and proves it to be a primordial and ultimate principle, ordained by the wisdom of the Supreme Architect." Now, Kinclaven must know, that all this is nothing, more or less, than sublime nonsense. By what intuition has La Place arrived at a knowledge sufficient to enable him to determine primordial and ultimate principles? Does Kinclaven imagine that the progress of inquiry in that direction is to be for ever arrested by the interposition of vague and pompous assertions signifying nothing? It might be much more safely asserted, that men will never arrive at primordial and ultimate principles; that there is no resting-place for the human mind.

An objection has been taken to the Newtonian philosophy, to which Kinclaven has deemed it expedient to make no reply:—That as the force of gravity acts against the momentum, the undiminishable must destroy the diminishable force within a given and not a very extended period of time. But we may take an objection on still higher grounds.

The Newtonian philosophy assumes that the motion of the planets is simply the continued effect of an original impulse imparted to them at the creation. Is this philosophy? Where is the demonstration? Where are the analogies? It is the philosophy of the trembling savage, who traces all physical effects to one unknown cause; the great connecting chain of cause and effect is almost wholly hid from his eyes. And because we have discovered a few of the inferior links (by far the larger portion being still obscured from our vision), it is confidently announced that we have arrived at a knowledge of primordial and ultimate principles. It is a natural tendency of the human mind thus to imagine. When we have traced from the effects to the causes till we can trace them no further, we speculate for a time upon the probable cause, but finding the problem insoluble, we cut the Gordian knot, we break the chain of cause and effect, and at once connect the whole of these effects with one unknown cause—presumptuously imagining that we have arrived at a knowledge of primordial and ultimate principles. All the operations of the Supreme Architect are consummated by the interposition and agency of secondary causes, by certain properties which he has been pleased to impress upon the elements of the material creation. It is the province of philosophy to trace and discover those properties and secondary causes, and by thus extending our knowledge of the things of nature, we are enabled to make them subservient to the well-being of man. Thus far may philosophy go, and no further. Whenever we advert to Divine Power for a solution of natural phenomena, we virtually confess that we have arrived at the limits of known causes—the boundary which separates the known from the unknown. Therefore, the gratuitous assumption, that the motion of the planets is the continued effect of an original impulse, is a virtual confession of our ignorance of the cause of that motion.

It would be as well if Kinclaven would give satisfactory answers to these two objections before he proceeds to judgment upon the electrical theory; until he has done so, all his flourishes about rigid demonstration are mere bombast.

I perceive that the electrical theory has received an attack from an "Old Correspondent"—but as he has very candidly confessed that he is totally ignorant of the subject, of course he does not require to be answered. He should have informed himself, however, a little better before he ventured to give an opinion, "that it is all nonsense."

Your obedient servant,
T. S. MACKINTOSH.

P. S.—I intended to have made a few remarks upon "the precession of the equinoxes being one of the perturbations that tend to give an eternal stability to the system," but perhaps it may be as well to let them stand over for the present; let us settle the point in hand first. In the mean time, I would recommend Kinclaven to take into his consideration

the progressive motion of the apogee in connexion with the supposition of the earth's motion in a spiral orbit.—T. S. M.

MESSRS. UPTON AND ROBERTS' SAFETY-LAMP.

Sir,—While such a difference of opinion exists on so important a subject as the safety of the Davy-lamp, it would be well that those who have the opportunity of proving it in practice, should communicate the result of their experiments to the public.

I am the more particularly induced to make this suggestion, from having remarked in Mr. Pereira's examination (vide *Mechanics' Magazine,* vol. xxiv. p. 338,) the following question and answer as referring to Messrs. Upton and Roberts' lamp:—"Have you made any experiments in coal mines with it? *No, I have never been in a coal mine with it.*"

To this question, Mr. Editor, I am prepared to give a different answer, having since the publication of the evidence alluded to, had many opportunities of trying in practice the merits of the improved lamp, the safety of which I am enabled to confirm from repeated proofs of the unfailing property it possesses of destroying internal combustion before the wire becomes heated to a state of danger.

In my experiments with Messrs. Upton's lamp, I would beg to observe, that I have also usually had with me a common Davy lamp, by which I have proved the important fact that the latter is still safe after the improved lamp is extinguished, having proceeded several yards with the Davy lamp after the other was put out, the inflammable gas repeatedly exploding within the cylinder.

The advantages of Messrs. Upton's lamp in practice appear to be these: increased light, greater security of the gauze from external injury, steadiness of the flame while travelling rapidly, or in passing through currents of air, and lastly, the impossibility of internal combustion being continued so as to endanger the fusion of the wire. The disadvantages of this lamp (for these it undoubtedly possesses,) are its great weight 3½lbs., and inconvenient height, 15 inches, both of which might, I think, be remedied in the construction without interfering with those principles which conduce to its *safety.* *I think it* will also be found that in the critical examination of workings where a viewer has to determine the safety of introducing candles, the common Davy will be preferred, as the glass prevents that nice observation of the flame within the lamp, which guides the experienced miner in his vitally important decision.

These crude remarks will, I fear, appear unworthy of a place in your valuable Journal, and to obviate this in future, I would suggest that communications of this nature might be rendered more valuable were some of your scientific correspondents to propose such a list of questions as might appear most important to be answered from results obtained from inflammable gas as actually evolved in mines by the inscrutable operations of nature, and differing, as there is too much reason to suppose it does, from the most carefully manufactured approximations of our ablest chemists.

I am, Sir,
Your very humble servant,
THE BLACK DIAMOND.

Kilburne, near Derby, Aug. 31, 1836.

A SIMPLE METHOD FOR DRAWING ON BOTH SIDES OF A BOARD WITHOUT EITHER BEING RUBBED.

Sir,—If the simplicity of any plan do not take away from its utility, perhaps the following contrivance (which occurred to me from reading one which had the same object in view in your Magazine), may on that score be acceptable. It is not at all unusual for draftsmen to be working at two different drawings at the same time; and in this case it would be very convenient to make one drawing-board answer in the place of being obliged to have two.

To effect this, I think that two slips of wood of the same thickness, provided with pins, say two at each end, and these made to fit in corresponding holes in the drawing-board at top and bottom, would be sufficient for the purpose. By these means a sheet of paper could be laid on both sides the board, and be used at the same time by reversing the pieces of wood from one side to the other, as occasion may require. The holes should be near the edge of the board to allow as much room as possible for the paper.

I cannot vouch for the originality of the above, as being so plain it may have

occurred to, and even been adopted by, many; but it has not come under my observation.

I remain, Sir,
Very respectfully yours,
FREDERICK LUSH.

August, 1836.

EXTINCTION OF RIVER-SIDE FIRES.

Sir,—I have been much interested by the various contrivances published in your valuable Magazine for preventing the deplorable calamities attendant upon fires. The recent event at London Bridge has suggested to me a mode by which fires in the vicinity of the river may be more readily extinguished. It is simply this:—Let one, two, or more floating steam fire-engines be moored at different stations on the river, each fitted up with paddle-wheels, and having every requisite, such as fire-escapes, &c., on board, and let them be *always ready for use.* The facility with which they might be brought to the scene of action at any state of the tide,* and the immense body of water which a small steam-engine would be enabled to throw upon a fire when its paddles were not at work, together with the frequent scarcity of water for the supply of land-engines, even near the river, induce me to believe they would be highly advantageous. The expense, either for first cost or keeping up a supply of steam, I do not think would be objected to, when we reflect on the loss of property† which might probably have been prevented within no very distant period, near to or upon the river and the docks, if only one floating steam fire-engine‡ had been regularly stationed at London Bridge, under the able management of the London Fire-Engine Establishment.

Should you think my suggestion worthy of notice, you will oblige me by calling the attention of proper parties to the subject.

I am, Sir,
Your obedient servant,
H. WALKER.

20, Maiden-lane, Wood-street,
Sept. 1, 1836.

FIRE-PROOF STAIRCASES.

Sir,—Among the various schemes for preventing the sad havoc which is so frequently the consequence of fires (in two many instances attended with loss of life or mutilation of limb), that which to me appears the most simple and the most efficacious is scarcely ever noticed, and I much fear will never be acted upon generally without legislative interference—I mean the construction of incombustible staircases. I am a builder in a small way, and being an operative mason, have always, without reference to the size of the house, put stone, or stone and brick to the first floor; even in fourth-rate houses this is quite easy, and little more expensive than wood. Two courses of brick for riser, and a rubbed York tread with the nosing rounded; the bricks faced with cement, and when dry painted stone colour. This looks well, and is lasting. Nearly all fires originate in the lower part of the house; and a moment's reflection will convince every one of the difficulty of the flames reaching and burning through a ceiling eight or nine feet high, except by means of communication afforded by the wooden staircase. Above the first floor, stone staircases, unless geometrical, are more difficult, on account of the necessary support taking up too much room. My present object is, however, to point out the advantage of having the lower staircase fire-proof, which perhaps would, in 99 cases out of 100, prevent the fire reaching higher if it commenced on the ground-floor, or afford an easy mode of escape should the fire take place in an upper story.

I remain, Sir,
Yours, very truly,
P. RAYNER.

Obelisk, Sept. 5, 1836.

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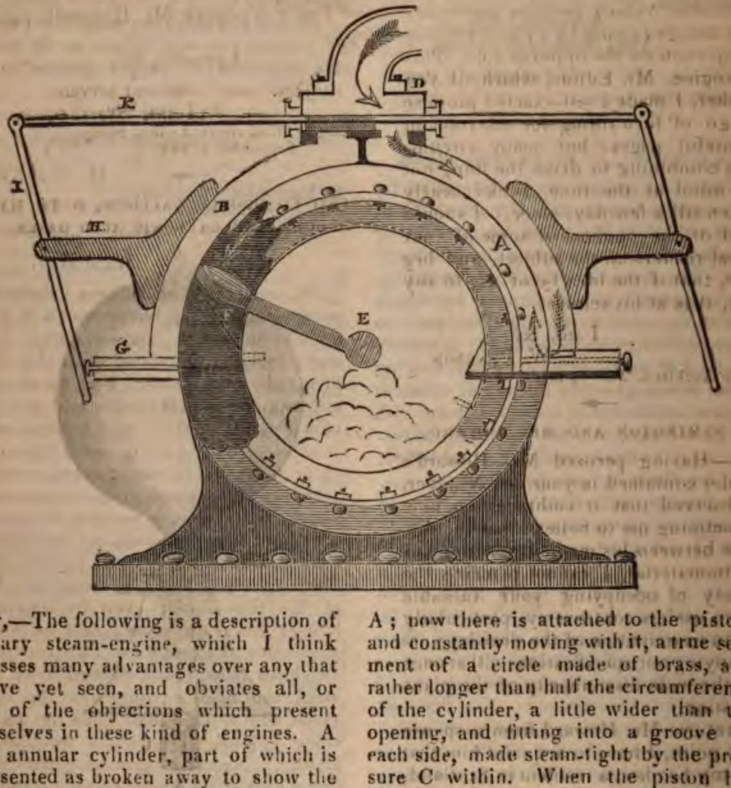
* The present floating-engine (by the report published in the *Chronicle*) did not reach the fire until two hours after it broke out; and although highly efficient on its arrival, it is awful to contemplate the amazing increase of a fire during such a period, and the relative difficulty of extinguishing it, in proportion to the length of time from its commencement.

† The loss at London Bridge, by the report above referred to, is estimated at about half a million sterling.

‡ Among other advantages likely to arise from the adoption of engines of this description, I think they might have a common fire-engine on board, with convenience for landing it in situations which could not be approached from the land side, where they could be effectively used; but I must beg to refer all details to the consideration of those more practically acquainted with the subject than myself.

PLAN FOR A ROTARY STEAM-ENGINE.



Sir,—The following is a description of a rotary steam-engine, which I think possesses many advantages over any that I have yet seen, and obviates all, or most of the objections which present themselves in these kind of engines. A is an annular cylinder, part of which is represented as broken away to show the piston and one of the sliding abutments. BB are the steam-ways from the slide-box D and steam-pipe C; E is the working shaft firmly fixed to the piston F; GG are the sliding abutments and cases, which are kept in their places by a sufficient pressure of steam, a spring, or a counterpoise (not necessary to be shown), so that when the inclined plane on the piston F has pushed it up and has passed, it immediately returns or shuts into its place again, having meantime reversed the slide-valve, and admitted the steam between the piston and itself, while the communication on the other side is cut off. H H are the supports to the levers I I, which, in conjunction, work the slide-valve by the continuous rod K K. It will be understood, that to allow the arm E and piston F to perform their revolutions, there must necessarily be a sufficient *ficient opening* right round the cylinder A; now there is attached to the piston, and constantly moving with it, a true segment of a circle made of brass, and rather longer than half the circumference of the cylinder, a little wider than the opening, and fitting into a groove on each side, made steam-tight by the pressure C within. When the piston has passed the abutment, the steam is reversed, and the semi-circular brass passing the other abutment, allows the steam that has done its office to escape into the atmosphere. Of course the sketch is a high-pressure engine, but it may be made a condenser by boxing in the cylinder, and having a stuffing-box round the main shaft, and conducting the exhausted steam to a condensor. This kind of rotary-engine is a direct accelerated motion, no stoppages, and there is nothing left for the momentum of the fly-wheel to perform,—the steam is always acting. It can be made either to advance or retrograde, merely by having an inclined plane on each face of the piston, and having the semi-circular brass to work easily through a guide in it, and being fitted with two projections, as shown by the dotted lines, supposing it were required to reverse the motion as shown in

the figure, the steam is let in, the piston and shaft retrograde, and the brass (or semi-circular valve) remains stationary till it is dragged round by a piston striking the projection on the opposite side. This is the engine, Mr. Editor, which, if you remember, I made a self-exacted promise long ago of forwarding for insertion in your useful pages; but many circumstances combining to drive the thing out of my mind at the time, I had nearly forgotten till a few days since. I should be glad of the opinion of some of your practical readers on the subject, and beg to state, that if the idea be of use to any person, it is at his service.

I am, &c.
W. PEARSON.

Bishop Auckland, June 7, 1836.

MR. SYMINGTON AND MR. HOWARD.

Sir,—Having perused Mr. Howard's rejoinder contained in your last Number, and observed that it embraces no new facts inclining me to believe that the difference between his method and mine is quite immaterial, I cannot perceive the propriety of occupying your valuable pages in useless controversy, particularly when an examination of the drawings accompanying our specifications will at once show the wide dissimilarity of the plans in question.

To relieve Mr. Howard from suspense on one point, I have to acquaint him that it was my brother, a resident in Scotland, but then on a visit to London, who called at Rotherhithe. But concerning that call I can truly say, he never mentioned a single syllable of having seen or heard of any particular plan of condensation.

In reply to Mr. Howard's questions, I have merely to observe, that what he terms *his* method or principle, described in italics in his last communication, has been in practice for forty years; and should he have any anxiety to see it in operation, I am ready to direct him to where he may satisfy himself.

I was not altogether aware, until Mr. Howard has been pleased to inform me, to what cause to attribute the being deprived of the Comet, and put to so much expense and inconvenience before I could even get the wheel tried with a vessel, the Alban, for which it had not been constructed. Thanking him for a piece of information which, when represented in the proper quarter, may prove useful; and freely accepting Mr. Howard's apology,

I remain, Sir,
Your most obedient servant,
WILLIAM SYMINGTON.

1, King William-street, London Bridge,
September 1, 1836.

IMPROVED DOUBLE BALLOON, WITH HYDROGEN AND CARBONIC ACID GASES.

Sir,—I take the liberty of sending you the following description of a machine which has occurred to me. Should you deem it worthy of insertion, it may at least suggest an improvement in ballooning.

I am, Sir,
Your most obedient servant,
ROBERT MUNRO.

August 24, 1836.

In the accompanying figure A is a

balloon of the common form and material filled with *coal gas.* B is another of smaller dimensions filled with *carbonic acid gas,* until its weight is nearly sufficient to prevent the rising of the machine; C, a car suspended from the upper balloon in the usual way; D, a slender steel-rod, or a rod of twined bamboo canes passing perpendicularly through these and fastened to the silk at A and B; E, a sail fixed to D; close to the ends of the rod there is a valve at each extremity opening inwards, and acted upon by a cord running alongside the rod and affixed within the car.

This machine does not require much explanation here; it need only be said, that while the contents of the upper balloon are nearly the *lightest* of aeriform fluids, those of the lower are the *heaviest;* consequently they will each exert a power acting differently. When the machine is afloat in the atmosphere, by permitting a certain quantity of gas to escape through the upper valve, this will diminish the ascending motion, which then yields to the heavier, and by acting similarly upon the lower valve a proportionate quantity of the carbonic acid gas will fall down and the effect will be reversed; and by a nice adjustment of both the powers, may be made to balance, and the machine will become *stationary* at any elevation.

Now, as the rod is continually kept in a perpendicular position by the opposing powers, and as the whole are connected together and kept uniform by it, it is obvious that when the machine is stationary it would move horizontally before any force opposed to it, consequently a sail might be applied, though the surface of the machine itself might be sufficient to cause it to move before the wind.

The above arrangement would be very suitable for taking plans and bird's-eye views. It is in the power of the voyager in the ordinary balloon to cause it to rest at any elevation, but this only by a very inconvenient process, and one that is not always practicable; but this advantage is possessed by the present to such extent, that the mere adjustment of an index may cause the effect; but all independent of the *safety* of it, which would bear the most severe breeze as its becoming disarranged or tossed, would be impossible.

I may mention, though well known, that carbonic acid gas is most easily procured, and at an expense far below that of coal gas or hydrogen.

ON AEROSTATION.

Sir,—Having, in my letter of the 1st ult. (see p. 307,) endeavoured to show the improbability of aerial machines tending to any useful purpose, while they retain their present form, I shall now add a few remarks, suggesting the form in which balloons ought in my opinion to be made.

In art we generally imitate the works of nature; now, all animated bodies intended for locomotion in the air or water have a head and a tail; man has imitated this in the ship, which has a stem and a stern; but in the balloon he has neglected his model, as at present made they have neither, and to this their mal-conformation alone must be attributed the repeated failures that have taken place in all attempts at guiding them. Upon this, I found the following observations:—

Balloons have two motions, a vertical and a horizontal; the former caused by the levity of the gas contained, and the latter by the prevailing current of air in which it ranges; and this latter is the movement that requires to be regulated, as the other can be varied by retaining or discharging of the gas or the ballast. Now, when it is considered how readily a vessel answers to her helm, and that water is to air as 832 to 1, I cannot conceive that it would be found so difficult a task to guide an *oblong machine* in such a yielding element as atmospheric air. I am aware that many scientific persons think differently; I would call the attention of such to an account in the daily papers, not many months ago, of one of his Majesty's ships, after losing her rudder and a temporary one in a hard gale of wind of several days' duration, having been steered up the Channel to Spithead by only attending to the trimming of her sails;—there are also other known modes of steering by the assistance of the wind alone. In short, I am doubtful whether machines to float in the air should differ, except in the *materials* for their construction, from those used to float on the water.*

* In comparing aerial with marine navigation, the fact is generally lost sight of, (as in the present instance by "Omri,") that in the latter case the vessel floats in one medium and is propelled by the

It is common with aeronauts now to ascend to a most unnecessary height for any experimental purpose: if ascensions were confined to a moderate height, sufficient for all the ordinary purposes of voyaging, descents might generally be more safely and rapidly effected in cases of danger. With respect also to the proposed enlargement of balloons, I would ask, are not two or three persons sufficient for philosophical or experimental trials? First let the aeronauts show the capability of guiding them, and capaciousness may then follow. When announcements like those of the proprietor of the "Eagle" and her seventeen passengers are made, I augur unfavourably of their performances adding much to our stock of knowledge. Proofs of the points necessary to be first ascertained might be made for a tithe of the money that must be expended in making a balloon of the magnitude of that now about to ascend from Vauxhall; for the fate of which all thinking persons must feel some apprehensions, notwithstanding its being under the guidance of the most experienced aeronaut of the day.

I remain, Sir, yours, &c.
OMRI.

London, September 4, 1836.

MR. GREEN'S GRAND NEW BALLOON.

This balloon, which, notwithstanding its great size, is inferior to the French aerial ship, which was exhibited at Kensington some time ago, has been constructed under the immediate superintendence of Mr. Green, the most experienced aeronaut of the age, he having made 220 ascents; the following particulars have been published with respect to it. It is 157 feet in circumference; and the extreme height of the whole, when inflated, and with the car attached, will be 80 feet. It is formed of 2000 yards of crimson and white silk. The method of uniting the gores (the invention of Mr. Green) is by a cement of such a tenacious nature, that when once dry, the joint becomes the strongest part. It contains 70,000 cubic feet of gas. The weight of atmospheric air sufficient to inflate it, is about 5346 lbs.; and that of the same quantity of pure hydrogen gas, about 364 lbs.; the machine would consequently, if inflated with that gas, have an ascending power of 4982 lbs.; and allowing 700 lbs. for the weight of silk and apparatus, and 362 lbs. for ballast, would be capable of ascending with 28 persons of the average weight of 140 lbs. each. But Mr. Green in his first experiments in aerostation, seeing the great expense, difficulty, and inconvenience of using pure hydrogen gas, conceived the possibility of substituting carburetted hydrogen or coal gas, such as is used for illumination; and first used it in his balloon which ascended on the day of the coronation of George IV. From that time the use of pure hydrogen has been almost, if not entirely, discontinued, the expense of generating it being six times greater than that of coal gas. The specific gravity of coal gas being considerably greater than that of hydrogen, it gives a balloon a much smaller ascending power; and the quality of coal used, and the methods employed by different gas companies in its manufacture are so various (the specific gravity having been found to vary from 340 to 790), that it is impossible to ascertain exactly what would be the power of a balloon inflated with it. It is, however, calculated that the new balloon will ascend with from eight to ten persons, besides ballast and apparatus; the power varying according to the quality of the gas, the state of the atmosphere, and a variety of causes. As a matter of curiosity, it may be stated, that the inflated silk will sustain an atmospheric pressure of 20,433,600 lbs., or 9122 tons. The net which entirely envelopes the silk is of hemp, and the car of basket-work; the grapple or anchor, is of wrought-iron, and will be attached to an elastic India-rubber cord from the factory of Mr. Sievier. This will prevent, in a very great measure, any sudden jirk in stopping the balloon in rough weather, whereby so many accidents have occurred.

The following are said to be among the advantages to be gained from the large size of this aerostatic machine:—A much greater elevation than has hitherto been attained, and the long agitated question decided as to whether there are, at a great altitude, currents of air proceeding in one direction for several months to-

help of another, whilst in the former it floats in, and is propelled by, one and the same medium.

gether. This Mr. Green, from many observations he has made, believes to be the case at an altitude where the atmosphere is not acted on by the reflection of the sun's rays from the earth, or dense masses of clouds. Should this theory be found correct, a grand step in the progress of aerostation will be made. The great power of the machine, even when inflated with coal gas, will enable scientific gentlemen to ascend with philosophical apparatus, for the purpose of making experiments on electricity, pneumatics, magnetism, &c. or astronomical observations, which, from the small dimensions of all other balloons, has been impossible; and this circumstance has caused them to be regarded by scientific men as mere objects of public exhibition. A small chamber to be attached, in place of the car, is about to be constructed for the above purpose, in which from three to six persons can ascend, with ample room and every convenience for experimental apparatus.

Mr. Green is, after all, of opinion, that aerial navigation is totally impracticable to any extent.

The tenacious cement above mentioned we suppose to be dissolved India-rubber, about which Mr. Green said so much in his examination on the Patent Caoutchouc Case, Macintosh *v.* Everington and Ellis. Should this be the case, we have our fears for the safety of the aeronauts. If the balloon, as is usual, be covered after being finished with a coating of mastic varnish, this will destroy the tenacious property of the caoutchouc, and unless the gores are also sewn as well as cemented, there is great danger of their giving way.

SHULTZ'S RAILWAY CARRIAGE SPARK-ARRESTER.

Report of the Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, to whom was referred for Examination a Spark-Arrester, invented by Mr. William Shultz, of Philadelphia.

That they have examined the plan of Mr. Shultz for arresting the sparks from locomotive-engines, and that its principal features and mode of operation are as follows:—

As in most other contrivances for this purpose, the one now before the Committee resorts to the use of the wire-gauze for intercepting the sparks.

But instead of having it on the top of the chimney in the form of a bonnet or cap, it is interposed in a horizontal plane near the bottom—a conical enlargement in the chimney being provided at that place to allow a sufficiently extended surface for a free passage of the smoke and heated air.

A small door in the side just above the gauze commands a view of the whole surface of the gauze for the purpose of cleaning, &c. The advantages of this arrangement are evidently three-fold. First, in admitting the escape-steam to be discharged above the gauze by the pipe passing through it in the middle, thereby avoiding the serious inconvenience of the meshes becoming choked by the combined effect of soot and moisture, which is felt when the steam is discharged below it. Secondly, in a better disposition of the weight of the apparatus, which in the ordinary mode makes the chimney top heavy. And, thirdly, in having all within convenient reach of the engineer. Besides the main, there are three considerable flues, which are occasionally opened by slides which draw horizontally for that purpose. These flues are on different sides of the chimney, passing outside of the sheet or disk of gauze, and serve to give additional freedom to the passage of heated air and smoke, whilst the fire is starting. In an apparatus of this kind, which the inventor stated had been tried on the Germantown-road, the enlarged diameter of the chimney was three feet in the clear, whilst that of the chimney proper was of the usual size of fifteen inches. The inventor likewise stated to the Committee that the experiment was entirely successful so far as a single trial could be depended on. The Committee are aware that the principle of placing the gauze below the point at which the escape-steam is discharged has been before attempted by putting it in the smoke-chamber. The objection to this plan seems to have been a too rapid destruction of the gauze by the heat to which it was exposed—a fate which it is feared in some degree awaits the present invention. But from the facility with which the gauze can be replaced by removing the upper section of the chimney, the opinion is entertained that this will be found the best arrangement which has yet come to the knowledge of the Committee for the accomplishment of this difficult desideratum.

By order of the Committee,

WILLIAM HAMILTON, *Actuary.*

March 11, 1836.

THE BRITISH ASSOCIATION.

"Ne sus Minervam!"

Sir,—Accounts are going the rounds of the public papers laudatory of several most "important and astonishing discoveries" that have just been made by members and friends of the "*Scientific Association!*"

Amongst others, we are called upon to stare our eyes out at the idea of crystallisation and other chemical aggregations being promoted, modified, and varied by galvanic, magnetic, or electric action! Another *novelty* is, by the journalists, attributed, some to Dr. Lardner; by others, to a Petersburgh engineer;—this consists in placing scrapers, brushes, or watering-pots in advance of the locomotive-engines on railways.

A third novelty is the traction of a barge on a canal, by means of a chain under water, passing over a drum moved by a steam-engine in the said barge, &c.; and there are many other similar "novelties" not worth naming. It is a pity that *inventors* do not make a point of looking well over the pages of your compenduous periodical, and so save themselves much trouble. With regard to the first-mentioned discovery, I beg to refer your readers to my letter in the *Mech. Mag.* for March, 1831 (Nos. 400, 401), wherein I not only point out the agency of the galvanic, electric, or magnetic fluids—all "aliases"—in the formation of chrystals, chemical assimilations, metallic aggregations, &c., but in the excitation and production of organic life, both "vegetaable" and "animal." But more of this on another occasion. With regard to the scraping, cleansing, and preparing the rails for the wheels of locomotive-carriages, you will find in one of your Numbers (435), just about three years ago, a suggestion of mine similar to this new novelty of to-day, with the addition, that *I* propose a slight sprinkling of powdered rosin on the cleaned rail, just before the wheels of the locomotive, by which the *adhesion* will be so increased, as to enable a much steeper ascent to be vanquished without the slipping of the wheels. The great *power* of locomotive-engines is of no avail, if their wheels do not hold on the rails; and I think that with the use of a little rosin on the ascents, some expense might be saved in leveling.

The drawing of barges along canals *by means of a fixed chain* and a drum provided with pegs around its circumference, I saw performed with great success by Captain Brown on the Regent's Canal in 1825.

I have the honour to be, Sir,

Your obedient servant,

F. Maceroni.

September 6, 1836.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The following is a list of the various grants of money for the advancement of particular branches and objects of science which were awarded by this Association.

Section A.—Mathematical and Physical Science.

250*l.* for the discussion of observations on the tides; at the disposal of J. W. Lubbock, Esq.

150*l.* for observations on the tide in the port of Bristol; to the Rev. W. Whewell.

70*l.* for the deduction of the constants of lunar mitation, under the direction of Sir T. Brisbane; Dr. Robison and Mr. Bailey.

30*l.* for hourly observations of the barometer and rock salt hydrometer; Mr. Shaw Harris.

100*l.* for the establishment of meteorological observations on a uniform plan, and experiments on subterranean temperature; under the direction of the Committee of last year, reduced to the Rev. Professor Powell, W. S. Harris, Colonel Sykes, and Professor Phillips—Sec., J. Phillips.

500*l.* for the procurement of data depending on very accurate measurement of points situate in two straight lines at right angles to each other, for the exact determination of the question of the permanence or variability of the relative level of land and sea; Committee, Messrs. Greenhough, Lubbock, Mackenzie, Whewell, Sedgwick, Stevenson, Robison, Bayley, Griffith, Colly, Cubitt, Porstock, and De la Beche—Sec., Mr. Whewell.

100*l.* for experimental observations on form of waves as influenced by the effect of winds, and the effect of the form of a canal, and the manner in which the wave is produced—John Robison, Sec., R.S., Edin., and J. J. Russel.

500*l.* for the reduction of the observations in the *Histoire Celeste*—and vol. ix. *Academie des Sciences*, 1789 and 1790; Messrs. Lubbock, Airy, Bailey, and Dr. Robison—Sec., Mr. Batley.

100*l.* for experiments on vitrification—Drs. Turner, Faraday, and the Rev. O. Harcourt.

80*l.* for the construction of a rock-salt lens—Sir D. Brewster.

Section B.—Chemical and Mineralogical Science.

50*l.* for researches on the specific gravity of gases—Drs. Henry, C. Henry, and Dalton.

15*l.* for researches on the components of atmospheric air—Dr. Dalton.

30*l.* for researches on the quantity of heat developed in combustion and other chemical combinations.

24*l.* 13*s.* for the publication of tables of chemical constants—Professor Johnston.

60*l.* for researches on the strength of iron made with hot and cold blasts—Messrs. Fairbairn and Hodgkinson.

Section C.—Geology and Geography.

20*l.* for experiments on the quantity of mud suspended in waters of rivers—Rev. James Yates, Messrs. De la Beche and G. Rennie.

30*l.* for special researches on subterranean temperature and electricity—R. W. Fox.

50*l.* for researches on the nature and origin of peat mosses in Ireland—Colonel Colby.

Section D.—Zoology and Botany.

25*l.* for experimental observations on the growth of plants under glass, and excluded from the air, according to the plans of Mr. Ward—Professor Henslow.

Section E.—Medicine.

50*l.* Renewed grant to the Committees appointed to investigate the subject of the anatomical relations of veins and absorbents.

50*l.* Renewal of a grant to the Committees appointed to investigate the subject of the motions and sounds of the heart.

25*l.* for researches into the chemical constitution of the secreting organs—Drs. Roget, Hodgkin, and Turner, and G. O. Rees, Esq.

25*l.* for investigations on the physiological influence of cold on man and animals in the Arctic Regions—Mr. Richard King.

25*l.* Renewed grant for the investigation of the effects of poisons on the animal economy—Drs. Roupell and Hodgkins.

25*l.* Renewed grant for the investigation of the pathology of the brain and nervous system—Drs. O. Beirne, Green, Macdonald; Messrs. R. Carmichael, Adams, and O. Smith.

25*l.* for the investigation of the physiology of the spinal nerves—Drs. Harpey and Broughton, and E. Cock, Esq.

Section F.—Statistics.

150*l.* for inquiries into the actual state of schools in England, considered merely as to numerical analysis—Colonel Sykes, and Messrs. Hallam and Porter.

Section G.—Mechanical Science.

50*l.* for an analysis of the reports of the duty of steam-engines in Cornwall—Messrs. J. Taylor, G. Rennie, and Cubitt.

RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal*, for July.)

WHEELS FOR RAILROAD CARS, *Arundius Tiers, Pennsylvania.*—The wheel is to be made of cast-iron, with a wrought-iron band shrunk upon it, to form the tread of the wheel. The form and shape of the respective parts of the wheels which the patentee prefers, are exhibited in the drawing.

In the construction of that part of the wheel which is made of cast-iron, the flanch A B, in the accompanying section, is chilled and hardened in the mould as it is cast, in the ordinary way of chill hardening cast iron. A small rim or flanch C D is formed and cast on the inner side, or face of the wheel; this rim is intended and used to confine the wrought-iron band which is afterwards to be put around the wheel. The wrought-iron band E F is first welded together in the form of a hoop, and then heated until it has expanded sufficiently to pass over the small rim, or flanch, above referred to, when it is allowed to become cool, and to contract upon the wheel as exhibited in the drawing. This wheel possesses all the advantages of a chilled cast-iron flanch, with a wrought-iron band or tread, and is therefore deemed to be decidedly preferable to the cast-iron wheels with wrought-iron flanches, inasmuch as the wrought-iron flanches soon wear out, especially on roads that have frequent curves in them. This wheel is also exempt from one of the greatest objections to the common, chilled cast-iron wheels, in being free from slits in the hub; the small quantity of metal which requires to be chilled in this wheel allows the wheel to be cast solid in the hub, and renders the precautionary operation of

slitting the hub entirely unnecessary. The shape of the band is that of a flat or oblong square, and hence it may be formed by the ordinary rolls; and consequently, when worn out, may be replaced at a small expense.

Improvement in Raising Sunken Vessels, *William Atkinson and Ebenezer Hale, New York.*—We prepare (say the patentees) bags which are impervious to air and water, and to them we attach hose, or tubes, properly prepared, and of such length as may be necessary for the intended purpose. The most effectual way of preparing such bags and hose, is by coating canvas, or other cloth of sufficient strength, with caoutchouc, or India-rubber, in a manner now well known. The form of the bags may be varied, but the best is that of a globe, as when they are distended by filling them with air, more will be contained under the same bulk than in any other form.

The bags should be properly strengthened by bands of canvas or cordage, and be sunk in the water, and firmly attached to the vessel, or other article to be raised, which may be done by means of a diving-bell, or in any other way which the particular circumstances of the case may render convenient.

The hose or tubes leading to each bag must be of sufficient length to extend from it to the apparatus by which the bag is to be inflated, which may be on board of a moored vessel, or otherwise. The distending apparatus will consist of a common condensing or force-pump, by which the air may be forced through the hose or tube so as to distend the bag.

It may be found convenient, and we sometimes intend, to fill the bags before sinking them, proper tackle and blocks being attached to, or passed under, the vessel or other article to be raised. The inflating of the bags may in this case be rapidly effected by the use of a large, common bellows. We intend, also, to use such bags, so inflated, within the hold, cabin, or other parts of vessels, which, when not wanted, will occupy but little space, and when required, may be easily inflated by a pair of bellows adapted to that purpose. In all cases, suitable air-tight valves or cocks should be employed, and such other appendages as may be found useful for coupling the inflating apparatus, or otherwise, when securing the air within the bag.

It is not necessary for us to prescribe the size or number of the bags to be employed; nor indeed would it be possible to do so, without assuming a particular case, but it is manifestly a thing of easy calculation, and one which must be made in every individual instance.

The patentee's claim is "the employment of bags rendered impervious to air and water, and *furnished with hose or tubes*, cock or valves, through which they can be filled with air, after being sunk and properly secured to a vessel, or any other article intended to be raised from the bottom to the surface of any water; or when first distended and afterwards sunk, as herein described. Also their use or employment for preventing the sinking of vessels or other articles."

Gentleman's Travelling Dress Hat, *Victor De Braine, New York.*—This is to be a kind of hat, the crown of which may be flattened down, its sides folding in like the leather of a pair of bellows. A thin metallic hoop is to surround the interior of the crown at its upper, and another at its lower part, and these are to be connected together by hinges, of thin steel, having a joint in the middle, and at its attachment to each hoop. These hinges fold inwards when the crown is depressed. An intermediate hoop is also employed to increase and regulate the fold. The claim is to the particular arrangement described.

It is unfortunate for the American inventor of this hat, that precisely such hats were made and sold in Paris, at least as far back as the year 1833, at which time a friend of ours bought one in the "Place des Victoires," in that city. It is rather too late, therefore, to re-invent the thing in New York.

Brake for the Wheels of Cars and other Carriages, *John R. Smith, Pennsylvania.*—This patent is taken for a self-acting brake, and the subject is treated as though such a contrivance had not previously entered into the head of any one. So confident is the patentee of this, that he says "I do not deem it necessary to describe very minutely any particular apparatus, as it must vary according to the construction of the car." It will be found, however, that the law requires such a minute description, although it does not compel the patentee to abide literally, but only substantially, by it. The claim is to "*the principle* of acting upon brakes by the contact and motion of the cars, by impeding, or stopping, the propelling power." Now the law does not grant patents for principles, but only for the means by which principles are carried into effect, yet all the information derived from the specification, on this point, is that the apparatus by which the cars are coupled is to be connected by rods, bars, or other contrivances, passing under the cars, and acting upon brakes, when brought into contact by the impeding of the locomotives, or from any other cause. We are also informed as regards common road carriages, that "any fixture on them to produce friction on the wheels, by the tendency carriages have to press forward on the horses, when descending hills, I should deem an invasion of my rights." Were such

really the case, the patent law, instead of "promoting the useful arts," would become the means of putting a stop to all further improvement in the means of accomplishing any object which had been previously effected in any way.

NOTES AND NOTICES.

Railway Performance Extraordinary.—The locomotive steam-engine George Washington, made for the State of Pennsylvania by William Norris, of Philadelphia, was placed on the Columbia and Philadelphia Railroad on Saturday afternoon, the 9th inst. On the following morning her powers were tested in ascending the inclined plane near Philadelphia. This plane is 2800 feet in length, with an ascent in that distance of 196 feet, or at the rate of 369 feet to the mile, or 7 feet rise in 100 feet, or 1 foot in 13. The weight of the engine is 14,930 lbs *only*. The load attached weighed 19,200 lbs., including the weight of 24 persons who were on the tender and burthen car. The engine started immediately at the base without a running start, and dragged up the said load of 19,200 lbs. the above distance of 2800 feet in the space of 2 minutes and 1 second, or at the rate of 14⅜ miles per hour; pressure on the boiler a fraction under 60 lbs. to the square inch. The engine then descended the plane with the same load at various speed, frequently stopping to test the security. The valves being reversed, or set for going a-head, and when it was desired to stop altogether, the steam was let on very slowly, which brought her to a dead stand for a second or two, when she would immediately start up the grade. In this way, stopping and starting at pleasure, the time occupied in descending the 2800 feet was from 12 to 15 minutes, thus testing the perfect security of her performance on the plane. She again ascended the plane with the same load, and took her place on the road, the same morning, ready for use.—*American Railroad Journal, July* 16.

Grand Junction Railway (connecting the Birmingham, and Manchester and Liverpool Railways).—On Wednesday last, the 31st ult., the annual meeting of the Proprietors of this Railway Company was held. A very able Report of the proceedings of the Company since their last meeting was read by their Secretary, Mr. Chorley, which gave general satisfaction. The whole of the line is in so forward a state, that it is expected it will be open for travelling early in the summer of 1837. Fourteen of the twenty arches of the splendid viaduct across the Weaver are finished; it, as well as the viaduct near Birmingham, will be completed next spring. There are several parts of the line ready for the iron rails being laid down. All the carriages are in a forward state, and 25 locomotive-engines will be ready for action in March. The contracts for the rails and chairs were made at a fortunate period, being at 15 per cent. less than they could now be obtained for. The income derivable from the Warrington and Newton Railway, now forming part of the general line, yields a surplus after paying the recent proprietors the sum of 4 per cent. per annum, as agreed upon to be paid to them until the opening of the whole line. The proprietors were unanimous in their desire to support the line between Manchester and Crewe, and to assist the inhabitants of the Potteries to form a branch line to the Grand Junction Railway near Newcastle.

Power-Looms in Glasgow have increased greatly of late years—some idea may be obtained of the extent of their use when it is known that in 1831 *four houses* employed 3040 looms. These looms, on *an average*, weave 14 yards each per day. Allowing each loom to work 300 days in a year, these four companies would throw off 10,101,000 yards of cloth, which, at the average price of 4½d. per yard, is 189,393*l*. 15*s*. per annum. The power and hand-looms belonging to Glasgow in 1831 amounted to 47,127, viz. steam-looms, 15,127; hand-looms, in the city and suburbs, 18,537; in other towns, for Glasgow manufactures, 13,463. Since that period power-looms have greatly increased.—*Athenæum Report of Meeting of British Association.*

Steam-Engines.—There are in Glasgow and its suburbs 310 steam-engines, viz. 176 employed in manufactories; 59 in collieries: 7 in stone quarries; and 68 in steam-boats. Average power of engines, 20·46-100th; total horses' power, 6406.—*Ibid.*

Iron-Works in Scotland in June, 1836.

Erected in or about year		Furnaces.	Tons.
1767,	Carron Company	5	8,000
1786,	Clyde	4	12,000
1786,	Wilsontown	1	3,000
1790,	Muirkirk	3	6,000
1790,	Cleland	1	2,500
1790,	Devon	3	7 000
1805,	Calder	5	15,000
1805,	Shotts	1	3,000
1825,	Monkland	3	8,000
1828,	Gartsherrie	5	15,000
1834,	Dundyvan	4	12,000
	Total	35	92,000

Exclusive of the above furnaces, there are eight additional ones in a state of forwardness—viz. two at Gartsherrie, one at Calder, one at Monkland, two at Somerlie, and two at Govan. These eight furnaces will make about 20,000 tons annually. These works are all in the neighbourhood of Glasgow excepting five, and none of them are thirty miles distant from that city.—*Ibid.*

St. Rollox Chemical Works.—This manufactory, for the manufacture of sulphuric acid, chloride of lime, soda, and soap, the most extensive of any of the kind in Europe, covers ten acres of ground, and within its walls there are buildings which cover 27,310 square yards of ground. In the premises there are upwards of 100 furnaces, retorts, or fire-places, and in one apartment there are platina vessels to the value of upwards of 8 000*l*. In this great concern, upwards of 600 tons of coal are consumed weekly.—*Ibid.*

Erratum.—P. 382, line 11, col. 1, for "precision of the equinoxes" read "precession of the equinoxes."

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

A complete list of Patents from the earliest period (15 Car. II. 1675,) to the present time may be examined. Fee 2*s*. 6*d*.; Clients, gratis.

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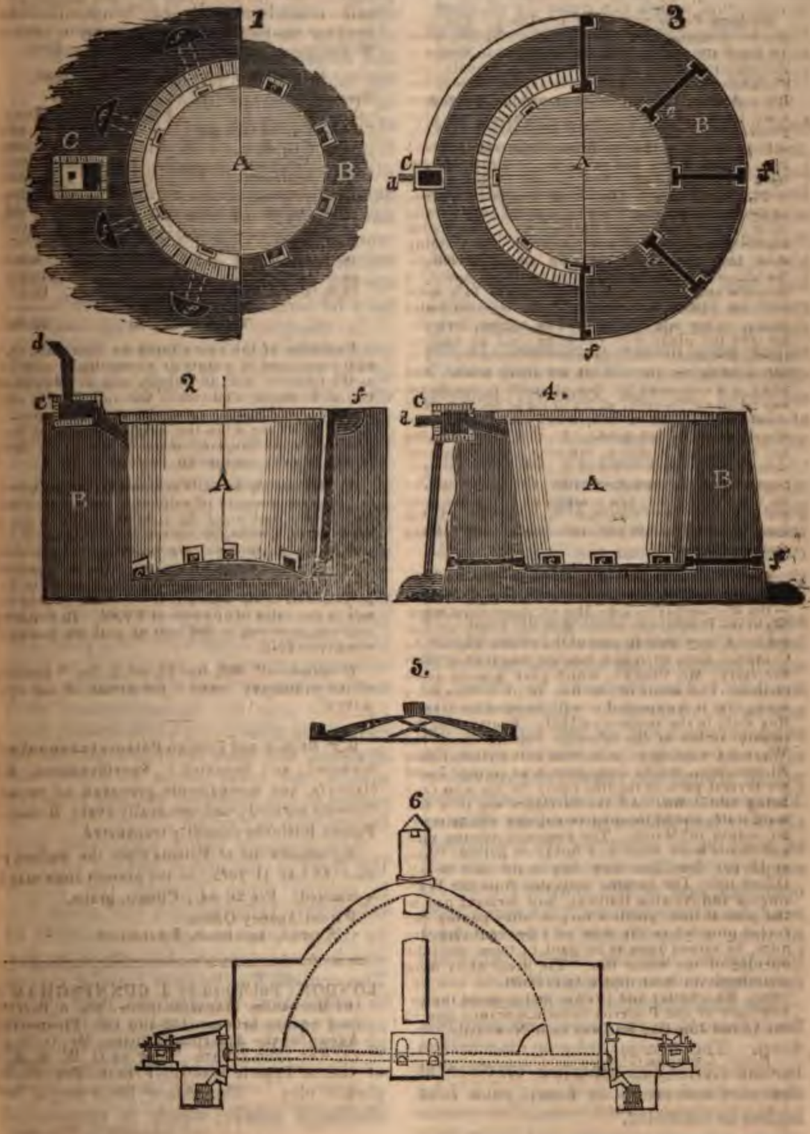
IMPROVED MODES OF PREPARING CHARCOAL.



IMPROVED MODES OF PREPARING CHARCOAL.

(From the *American Railroad Journal.*)

In consequence of the great waste of charcoal, in the usual mode of preparation, and the entire loss of the volatile matter, two modes have been contrived, in either of which the quantity of charcoal obtained may be almost as large as in iron cylinders, and the volatile matters may be collected.

The first of these is best suited to the hard woods which contain but little sesinous matter. This operation is performed in a kiln of the shape of a cylinder, or rather a truncated cone, whose larger base is uppermost. It may be built of sods or tenacious earth above the natural surface of the soil, but may be more conveniently excavated to such a depth that the earth thrown out may serve to form the upper part of the enclosure. In the only instance in which we have seen it employed in this country, namely, at the West Point Foundry, the excavation is lined with brick.

In order to admit air to the kiln, when made by excavation, for the purpose of maintaining the combustion, tubes of earthenware or cast iron are carried down from the surface of the ground to the bottom of the excavation; these lie behind the lining, and are either passed through it near the bottom, or enter small brick vaults, which communicate with the interior of the kiln. The kiln may be closed at top by a cover made of sheet iron, to support which, when the lining is not of brick, a ring of bricks must be placed around the top of the excavation. The cover must extend on all sides three or four inches beyond the opening of the kiln, in order to have a sufficient support. In this cover there are several openings, one at the centre, the others near the circumference. Through each of these a short tube or flue of sheet iron passes, and the several tubes are furnished with stoppers of iron.

The size described by Dumas is ten feet (French) in diameter, and nine feet deep. The central tube is nine inches in diameter. The number of these at the circumference is four, each four *inches in diameter.*

That used at the West Point Foundry is twelve feet in diameter and nine feet deep.

In order to condense the volatile matter, one opening is made in the lining near the top of the kiln, to which a tube of cast iron or earthenware is applied. This tube communicates with a small chamber built of brick, about eighteen inches long, a foot in width, and fifteen inches high, entering about the middle of its height. From the top of this chamber proceeds a pipe of sheet iron, which after rising vertically four or five feet, assumes a horizontal direction for about fifteen feet more; at at this distance there is no fear of fire, and the rest of the pipe may be of wood. The extension of the pipe communicates with a condensing apparatus, on the principle of Woolf, but which may be formed of common barrels.

In charging the kiln with wood, a post whose height is equal to the depth of the excavation is set up in the middle, and supported in its place by a heap of fragments of charcoal. A number of the larger logs are chosen and laid on the bottom of the kiln in such a manner as to form rudiating flues, terminating at the places when the air tubes pass through the lining. Across these a horizontal layer of logs is laid. The radiating logs must neither touch the post or the lining of the kiln; the secondary layers extend from the one to the other. Layers are then placed in succession in such a manner as to leave as little empty space as possible, particularly near the circumference, until the kiln is filled. The kiln having been charged, the post is drawn out of the middle, the cover set in its place, and coated to the depth of not less than two inches with dry earth.

The stoppers being withdrawn from the flues in the cover, lighted charcoal is poured down through the middle tube; this falls through the space left by the post, to the heap of charcoal by which it was steadied, and sets it on fire. The central flue is then tightly closed, in order that the draught may be directed towards the outside of the mass of wood. In order to make the joint of the stopper tight, it is luted with plastic clay. The other flues begin to discharge smoke, which is surrounded

by flame. As soon as the flame ceases to have a blue colour, and becomes white and clouded, the flues have their stoppers loosely applied to them, and the openings of the descending air tubes are diminished. The draught will thus be directed to the condensing apparatus. But if the collection of the acid be not intended, the tubes in the cover are but partially closed. The combustion may be regulated within the kiln by the air tubes and those in the cover. Thus, too rapid an action in any one part may be checked by completely closing the several air tubes and the opposite flue; and if it be too slow, these must be opened as far as possible until the action be restored.

For a kiln ten by nine, the operation occupies from sixty to eighty hours, and is known to be complete when the upper layer of wood appears to be incandescent; when this has taken place, the stoppers of all the openings except that of the central flue are removed for a short time, and a quantity of hydrogen will be expelled, which, if it does not injure the quantity of charcoal, would render it less saleable. As soon as the peculiar flame of hydrogen ceases, all the openings, both of the air tubes and flues, must be closed by shutting their stoppers with clay, and covering them with caps of sheet iron containing clay. The dry earth is removed from the cover, and it is plastered with earth mixed with water. The charcoal thus shut up will take sixty to eighty hours to cool.

A plan and section of this description of kiln is represented in fig. 1, 2, 3, 4, and 5.

Fig. 1, and 2, being plan and section of one formed in an excavation, and

Fig. 3, and 4, of one built above ground.

Fig. 5, cover of sheet iron applicable to either.

A. Interior of kiln.

B. Wall, or lining of earth.

C. Chamber in which the tar may be condensed.

d. Pipe leading to the condenser for pyrolignous acids.

e, e, e. Air-vaults.

f, f, f. Openings by which the external air is admitted.

At the Bennington furnace, a kiln of similar form was constructed of brick, above the level of the ground, and covered by a permanent dome of brick. In the wall a door was left for the introduction of the wood, and this was subsequently bricked up. Vents were formed by leaving bricks loose in the wall, and when the process was complete, the fire was extinguished by means of water. An unexpected benefit was found to arise from the latter operation; for the coal becoming charged with aqueous vapour, was as fit for immediate use, as that which had been prepared for several months.

It is estimated that the product of kilns of this kind in France, is about 25 per cent. more than in a coal-pit. The experiment at the West Point Foundry was more advantageous, the product having 50 per cent. more than was obtained in the usual method. In France the main object was the pyrolignous acid; which at West Point was neglected; and this difference in the object will account for the differance in the results. The mode of placing the wood was also different; the French using that which has been described above, while at the West Point it was placed vertically.

In the pine forests of Sweden, an apparatus better suited to the collection of the turpentine that kind of wood furnishes, has been invented by Schwartz. This kiln is composed of a vault, built of brick or siliceous stone laid in a mixture of clay and sand. Common mortar must not be used, as it would not only be effected by the heat, but would be completely destroyed by the pyrolignous acid. The vault is closed at each end by a vertical wall of the same kind of masonry. The floor of the kiln is of earth, and has the figure of two planes slightly inclined, and meeting in a gutter in the middle of the longer sides of the vault. In each end wall are two fire places, and in one of them are four openings for introducing the wood and withdrawing the charcoal. The smoke and vapour are carried off by flues of cast iron at the level of the ground, and proceeding from the middle of the larger sides of the vault; these minate in channels where the vapour is condensed, and which convey the smoke

to two vertical chimneys. A section of this kiln is represented in fig. 6.

The advantage of this arrangement is, that no air can enter the kiln without passing through the fire-places which are kept full of burning fuel; and that the fuel which is best suited for this purpose (small branches and twigs), is useless in making charcoal. In placing the wood, the pieces are laid parallel to the largest sides of the vault, and in such manner as to leave as little space as possible except in the neighbourhood of the flues, which must be kept free for the escape of smoke and vapour. Two days are sufficient to convert the wood into charcoal, and the end of the process is known by the appearance of the blue flame of carburetted hydrogen at the chimneys. The whole of the openings are then closed, and with luted clay.

At the end of two days, two holes, left for the purpose in the arch of the vault, but which have during the process been carefully closed, are opened, and water thrown in to cool the charcoal; these holes are then closed again. At the end of three or four days more, one of the doors in the end wall is opened, and more water thrown in; but the charcoal will not be ready to be removed, until all the external parts of the apparatus have become as cold as the surrounding air.

This kind of furnace has been much used in Europe, and the quantity of charcoal obtained is one-third more than is obtained from coal-pits. The turpentine and arcetic acid are also saved, which in other cases are lost. There can be no doubt that it might be introduced to advantage in those parts of our country where iron is manufactured by means of charcoal prepared from pine wood.

In using kilns of either description, it becomes a matter of calculation whether it be cheaper to manuafacture the charcoal in the woods in the usual manner, or to carry the wood to the kiln. The weight of the charcoal to be transported will be only seventeen parts of that of the wood; while the charcoal obtained by the kilns will be certainly one-third more than that procured from the pits. It must therefore appear that the value of the additional charcoal shall be at least equivalent to the cost of transporting the wood to the kiln. It is also to be remarked, that charcoal prepared on the spot where it is to be used is better than that which has here been handled and carried over rough roads, and that all waste is avoided.

THE BRITISH SALMON FIHERIES, WITH PROPOSAL FOR THE INTRODUCTION OF SALMON INTO THE RIVERS OF FRANCE.

Sir,—Although the following communication does not immediately apply to the extension of any merely British source of industry and utility, yet, as it may convey a useful hint to our neighbours, I think you will afford it a place in your widely-circulating miscellany, in deference to the maxims so well and philosophically expressed in the lines of Pope:—

> "Self-love but serves the virtuous mind to wake,
> As the small pebble stirs the peaceful lake;
> The centre moved, a circle first succeeds,
> Another still, and still another breeds;
> Parent, friend, neighbour, first it does embrace,
> Our country next, and next all human race."

This is the maxim and rule of action. But it is not impossible that some Englishman, or Englishmen, might take advantage of my suggestion, and turn it to good industrial account, by application to the French Government.

"*Translation of a Letter addressed to Count Martignac, Minister of the Interior to the King of France, dated* 24*th of March*, 1828, *and Duplicate sent* 20*th of January*, 1829.*

"Excellence,—I have often contemplated with satisfaction, the great advantages which would result to that part of France situated at the mouth and along the course of the Rhone, if salmon were introduced into that beautiful river, which possesses advantages above any other in Europe for the propagation and supply of that valuable fish.

"Salmon do not frequent the seas or rivers of warm latitudes: they delight in a rather cold climate. In Europe, the most southern limits of their visits are the rivers of the north of Spain, in the 44th degree of latitude. No salmon are found in the Mediterranean, because, as they do not exist in the Black Sea, they can only come from the Atlantic Ocean; and in order to get admittance by the only inlet on that side, they

* No answer returned.

would have to descend southward to the Straits of Gibraltar, which, being in latitude 36°, is beyond the limits of their southern migrations. The mouth of the Rhone is in the same degree of latitude as the river of St. Andre, where I have found salmon to abound, that is, in 44°; and the waters of the Lake of Geneva, and of the little rivers that flow into it, which may be called, as regards the salmon, the *terminus* of the Rhone, are pretty nearly of a similar temperature with the Scotch and Irish rivers, which they so much frequent.

"Several of the salmon fisheries established on the Tweed, the Tyne, the Shannon, and the Eden, produce an annual revenue of 5000*l.*, 7000*l.*, 10,000*l.*, and 12,000*l.* a year to the proprietors. Near the mouth of the river Eden, as many as 882,000 large salmon have been taken in 72 days.

"The propagation of fresh-water fish, which is somewhat attended to in districts remote from the sea, can never become an object of national importance, or of extensive sustenance, because such fish, as trout, pike, perch, and eels, being fish of prey, can never be produced in a lake, or pond, or river, beyond the number that can be supported by the small fish on which they live, that are furnished by the same confined waters, for their sustenance. Carp and tench may be fed on grain, &c.; but salmon are fed *gratis* on the vast stores of the extensive ocean. After the salmon has gained a rapid growth —through the inexhaustible store of food, which he knows where to find in the sea—he returns to our shores; ascends the rivers; penetrates into the interior of nations; mounts up to the very sources of the streams on the highest table-lands, and gives himself up, well fattened at the expense of the ocean, to people who, perhaps, know little of the sea, but from the rich tribute which it thus annually sends them.

"I do not here propose to address to your Excellency a *regular* treatise on the habits and natural history of the salmon; but it is necessary that I should remind you of the fact, that this fish returns periodically, with entire constancy during the whole of its life, to the river which gave it birth; and that whenever any number of salmon were let free, in an appropriate river, during the season which precedes their spawning, there would not be one of them that would not hasten to mount against the stream until it had found a fitting place to stop and deposit its eggs.

"Salmon begin to enter the rivers of Scotland and Ireland, more or less, about the month of April; it is, however, in June and July that the greatest quantity arrive. It is immediately after its arrival from the sea, in which it has been long living on abundant and nourishing food, that the salmon is in perfection. Its flesh is then of a bright, deep red colour; but in proportion to its sojourn in the fresh water of the rivers, in which it, comparatively, eats nothing, and as the time of its spawning approaches—it deteriorates in quality from day to day, its beautiful colour fades by little and little into a dirty yellow, its delicious flavour is lost and becomes flat and disgusting, its firm and solid flesh becomes flaccid and almost gelatinous, and an hitherto wholesome and nourishing article of food has become pernicious and disagreeable.

"The *ovarie* of a female salmon, of the age of four or five years, contains generally rather more than 600,000 eggs. It appears that, at variance with the habits of many other fishes, one male only is attached to one female. About the month of December, the former aids the latter in digging with the nose a furrowed bed in the gravel, in which furrows the female deposits her eggs. The male then completes the work, and covers the eggs over with gravel, as a gardener would a drill of spinach. According to the season, but generally about the beginning of March, the eggs begin to hatch; the first appearance of which most closely resembles that of a bed of onions just beginning to grow. The shells of the eggs and the heads of the fry being still engaged in the gravel, the tails are seen standing up erect for several days before the detachment occurs.

"I beg to assure your Excellency, that on this subject I can speak from some experience. I am much addicted to angling, have caught many salmon with the hook and line, and have had many opportunities of personally observing their habits. To another point, also, I have paid much attention, and that is, to the best method of keeping fish alive, and transporting them to a distance. I furnished a curious instance of this knowledge, on behalf of the late King of Naples, when I had the honour to be one of the '*Captains of the Chase*.' With the particulars of this procedure, which was much noticed by men of science at Naples, I will not trouble your Excellency; but I will only state, that I can point out a sure and cheap method by which 50 male and 50 female salmon may be conveyed, either from a Scotch or French salmon fishery, and turned out alive, safe and sound, into the Rhone, somewhere about Avignon. As sure as that a stone thrown up into the air will fall again to the earth, so surely will the salmon so turned out immediately betake themselves to ascend the stream, and in due time deposit their eggs in the Lake of Geneva, and its innumerable ingressing rivulets, localities pos

sessing advantages and capacity for that purpose greater than all the rivers of Scotland and Ireland put together!

"At the rate of only 100,000 fry, produced by each female salmon introduced, we should have 5,000,000 of fry, without reckoning that the original fish would return (barring accidents) to the same river to lay their eggs the next year, and so on in succession to the end of their lives.

"The young salmon hatched in March go down to the sea in September. They return next March, to stay only till July, when they weigh from 2 to 4lbs; next spring they return again, of the weight of from 6 to 10lbs.; and the third year, they weigh from 15 to 25lbs.

"Thus at the expiration of three years the produce of the first spawning, weighing from 15 to 25lbs., would begin to breed at the rate of 500,000 each; and then a commencement might be allowed to the fishery, which in such a river, and conducted under proper regulations, would in all probability yield not less than 1,000,000 francs (40,000*l.*) annually!

"The British salmon fisheries would undoubtedly produce more than ten times what they do, were the laws which are intended to protect the propagation of the salmon better digested, and, above all, better enforced. There are numerous Acts of Parliament on the subject, all pulling one against the other. A penalty is enforced against the *taking* of salmon, but none *against its public exposure for sale* during the prohibited periods. The *sale* of hares, partridges, &c. is punished; but a matter of *national* interest is neglected, as beneath the notice of our hare-killing legislators! One river has one law; a second has another; and so has a third! It is unlawful to take salmon *at the mouth* of *some* rivers with what are called *stake-nets* (which, by-the-bye, under due restrictions, is the best plan), and in others it is the only way pursued! In fine, there is no well-digested law in England on the subject. In some districts remote from the sea, almost every female salmon is speared by the peasantry when in the act of spawning; and no punishment is awarded to the wholesale destroyer, who obtains nothing but poisonous food for his pains. Should your Excellency do me the honour to reply to this communication, and require my suggestions, I shall be able to lay before you a well-reasoned and clear statement of the laws and regulations which ought to be enacted on the subject of salmon fisheries; and also on other fisheries in general, not forgetting that of oysters, which is sadly mismanaged, both in England and France.

"*There is not* a doubt but that when once salmon shall become indigenous in the Rhone, the 'surplus population' of these colonists will spread far and wide, and, by degrees, populate or salmonate all the rivers that fall into the Gulf of Lyons, and of the Mediterranean in general. It has been said most justly, that 'eternal honour would be due to him who should cause *two* blades of grass to grow where only *one* had thriven before.' Not only posterity, but the present generation, will have cause to bless the name of your Excellency, if, by your instrumentality and patronage, a vast, gratuitous, and unlooked-for supply of delicious human food is wrested from the bosom of the ocean for the daily benefit of thousands of your countrymen.

"The expense of carrying into effect the useful introduction I have suggested to your Excellency, would not exceed 40,000 or 50,000 francs. Should it be undertaken by an individual or by a Company, it would be well worth while for the Government, on the ground of national utility, to grant a special privilege of the fishery within a certain distance from the mouth of the river, of ten or fifteen years, beginning from the third year after the introduction of the salmon.

"I have the honour to be, your
"Excellency's humble and obedient servant,
"F. MACERONI,
"Officer of the Legion of Honour, &c.
"London, March 23, 1828."

ELECTRICAL THEORY OF THE UNIVERSE —REALITY OF AN ELECTRIC FLUID.

Sir,—I beg to forward to you the following remarks on "Mr. Mackintosh's Theory of the Universe," more particularly in reference to Kinclaven's communication in No. 682. I shall confine myself to one point of the controversy,—viz. that respecting the materiality of what is termed the electric fluid, which Kinclaven seems to call in question, quoting as his authority, what he most appropriately terms some "*remarkable* observations" of Sir John Leslie's.

Before, however, I proceed fairly to discuss the point, I will candidly express my opinion,—an opinion formed from a perusal of Kinclaven's communications, that he is, himself, too much of a mathematician to entertain any doubt in his own mind upon the subject, notwithstanding the *ipse dixit* of a philosopher, whose opinion must claim the attention, even of those who differ from him; and that, consequently, Kinclaven has made use of these truly remarkable observations of Sir John Leslie's, solely for the

purpose of throwing a stumbling-block in the way of Mr. Mackintosh. I trust I may be in error; for the legitimate aim of all controversy is the attainment of truth; and this aim cannot be accomplished by a subtle and ingenious system of special pleading, pressing into our service the opinions and assertions of others, not because they coincide with our own ideas, but merely because they militate against those of our opponent. But to the point.

I confess myself to be an humble individual of that humble class of reasoners, alluded to by the learned professor, who conceive that the *cause* of that by which *sensation is affected*, and *a material impulse experienced*, must itself be *material;* and that as sensation is affected by, and a material impulse experienced from electricity, the cause of electricity is corporeal; and, farther, that as it possesses, in an eminent degree, the properties of a highly elastic fluid, we humble class of reasoners must be content, in our darkness, to consider it as such, until Sir John Leslie, or some other philosopher, proves the contrary. For, after all, to what do the learned professor's observations amount? He wishes to object to and set aside a theory, not only without substituting a more satisfactory one, but without favouring us with *any* other! unless, indeed, the unintelligible sentence with which the extract given by Kinclaven concludes, be an attempt at such substitution. If so, I ask Kinclaven to state candidly whether he comprehends the learned professor's meaning. It is impossible; for I think it would be no very difficult matter to prove, by the professor's own words, that he did not understand it himself. What, for instance, is the meaning of the "colour of *emission!*" And what the explanation of the assertion, that the "colour is modified by the peculiar character and intensity of the retaining force? What is retained? and what force is here alluded to? To the former question, I presume the reply is, "the particles of light," which the learned professor speaks of in the same sentence, as being "disengaged from the surface of the conductor." This light, then, according to the learned professor, is not the *electric* light. And this materially weakens his own position. For if there is a retaining force, and the power of that retaining force is overcome by electricity, then the cause of electricity must be material; and, as the retaining force was overcome by the *elasticity* of that material something, I ask, whether it is more philosophical to deny, or to admit the claim of electricity to the title of a material fluid. The learned professor amuses himself at the expense of the blindness of those who "complacently describe the play and vagaries of an *electrical current whose existence was never proved.*" To this I shall not add an observation, but content myself by supposing that, at the time it was written, the new wonders of the science of electro-magnetism had not yet penetrated so far north as the modern Athens, and by assuring Kinclaven that numbers of scientific men, whose names I am not worthy to mention, will peruse the learned professor's observation with even greater complacency than their countenances assumed when they described the "vagaries of an *electric current.*" The learned professor proceeds to state, that "we are acquainted only with electric attraction and repulsion, and with the transmission of electrical influence, and that all beyond this rests on hasty conjecture!" Now, if Kinclaven will inform us what is the transmission of the electrical influence, *and how it is effected*, I shall be happy, also, to reply to this. In the mean time, I may add that by far the great majority of electricians believe the phenomena of electricity to be produced by a subtle fluid, or by two fluids. And, unsatisfactory as our present theories may appear to be, we must be content with them until a more satisfactory theory is framed.

I beg leave to assure Kinclaven that these observations are not the result of any wish to take a part in the controversy respecting Mr. Mackintosh's theory; believing, as I do, that, in nine cases out of ten, controversy tends rather to retard than to advance the true interests of science. I have, and trust I ever shall keep, but one object in view—the attainment of truth.

Before I draw this letter to a close, I may congratulate myself, in being able to unite with Kinclaven, in his admiration of our great NEWTON. He, at least,

Kinclaven will readily admit, was a man not given to "hasty conjecture." I cannot, therefore, more appropriately conclude this tedious communication than by referring him to Newton's "Optics," (8vo. edit., pp. 324 and 327,) by a perusal of which he will learn it was the opinion of that philosopher, that *electric bodies, when excited, emitted an elastic fluid.*

Yours, &c.
WILLIAM LEITHEAD.

22, Compton-street, Brunswick-square
12th September, 1836.

IMPRACTICABILITY OF AERIAL NAVIGATION — MONTGOLFIER'S PREFERABLE TO GAS BALLOONS.

Sir,—The subject of aerostation has been more fully and better discussed in your periodical than in any other; but although your intelligent correspondents have, during the last twelve years, supplied you with numerous observations and ideas on the subject, nothing essentially new or important has been elicited. This comes from the sterile nature of the thing itself. No one, as the homely saying is, can "make a silk purse out of a sow's ear." It is quite astonishing to observe how so many men of good sense can talk of propelling and *directing* a balloon through the air, on principles derived from "the way of a ship on the sea!" A vessel either on or in a mass of water can be propelled even *against* a current of that water, because the density of the medium allows of a power being applied of a velocity within the reach of our physical organs to produce. But for a power to be applied (in an analogous way) in the car of a balloon, against the air, in which the whole machine is immersed, it must have six hundred times the *velocity* of the stroke which will produce the same effect upon the water. Some persons say, "we will take up a steam-engine," &c. But the more weight you take up, the greater must be the dimensions of your balloon! After all—for it is loss of time to argue such a matter—it is evident that no power can draw a balloon against the slightest zephyr, but one which would *place the car and the balloon on an horizontal line together*, like a horse drawing a cart! With regard to the elongated and fish-like shapes that have been so often proposed, the fallacy is still more afflicting. When there is no power of propulsion through the fluid, how can the position of the elongated body be decided? Even a barge going down a river *along with the stream* has not the least power of steerage by the rudder, because it does not go *through* the water, but *with* it: without *external* power applied, either of traction, oars, or wind, it goes along sideways, or any way, just as it may happen. Another fallacy in the ideas connected with an elongated fish-like balloon, is also of a serious nature, setting aside the *physical impossibility* of propelling it. How is it to be kept in a horizontal position? A balloon of such a shape (like Egg's, the Pall-Mall gunsmith, or of Col. Lennox's "Aerial Ship"), being filled with gas and set up without any load, would certainly be liable to rise in any way but the one desired. If to prevent its bursting by the expansion of the gas, it were only three quarters or two-thirds full, it is ten to one but that it would rise up *endways*. If a net, car, &c. were to be attached to it, with a load of passengers, it would double up into the shape of a crescent; that is, if the gas did not rush *to one end* (which is most likely), and so defeat all the fish-like calculations of the constructors! A stout back bone to the fish-balloon might prevent the doubling up I speak of, but it would not save it from the chance of going up endways, much to the inconvenience of the travellers in the car beneath. But it is absolute waste of time to dwell on such nonsense. It is a pretty thing to see a balloon ascend when you are near it at the time, and will answer the purposes of the proprietors of public gardens, &c. The near view of any large mass in motion, such as a ship launched, a huge tree falling, &c. convey a novel and peculiar feeling to our senses.

In 1810, Madam Blanchard, the widow of Blanchard who, with an Englishman, crossed in a balloon from Dover to Calais, arrived at Naples with her balloon. An ascent was ordered by the King (Murat) to take place from the *Campo Marte*, on an occasion when there was to be a grand review of troops. In consequence of my known chemical propensities, the King ordered the talented Giovanni Dall' Armi and myself to make all the preparations,

and superintend the inflation and ascent of the balloon. It was settled that *I* was to have ascended with Madam Blanchard; but owing to the exhibition having been countermanded on account of the weather, after operations had began, and then re-ordered, the balloon was not sufficiently buoyant at the hour appointed to carry two persons, so *I*, to my great chagrin, was left behind. Madam Blanchard had in her possession a Mongolfier balloon, which she sold me for 40*l*. With that balloon I purposed making a series of experiments upon that principle alone, of which, in my opinion, balloons can ever be made to take advantage, which is, various currents of air crossing each other at different elevations in our atmosphere.

A balloon filled with hydrogen gas, provided with sand-bags for ballast, &c. can only rise by throwing out ballast, and descend by allowing an escape of gas. It is evident that these operations cannot be repeated beyond a certain limit, because you have no means of replenishing the ascending power. A Mongolfier balloon is inflated and rendered buoyant by means of flame, just like the paper "fire-balloons" of our tea-garden entertainments. A Mongolfier balloon, made of cotton "broad cloth," forty feet diameter, will carry up four persons. A circular grate or fire-place, of three feet in diameter, is suspended concentrically in the inferior opening of the balloon; which opening is about seven feet in diameter. Around this opening is a wicker gallery (instead of a car, as in the gas balloons). The persons in this gallery, being provided with a store of little faggots of dry wood and a long-handled fork, keep up the fire by supplying it with fuel. When it is desirable to descend, the fire is allowed to wane; an increased fire occasions a rapid rise. Thus it is absolutely at the discretion of the aeronauts to rise or fall, as long as their fuel endures. The fire-grate is provided with a hinged cover, so that it may be extinguished at once, or the bottom of the grate may be let out, so as to vacate all the fuel. With such a balloon, even when the fuel is *all* expended, a fresh supply may be had almost any where; and thus the search after various currents of air may be far more successful than with one of hydrogen gas. I look upon the Mongolfier balloon as less liable to accident than the other, which is liable to burst, or to be ignited by an electrical discharge from the clouds, or to fall too rapidly through any over-opening of the valve. The flame from the fire-place of a Mongolfier balloon ascends vertically into the interior without the slightest vacillation. The flame of a candle in the car of a gas balloon could not move were it blowing a gale of wind, because the balloon goes *with* the wind. But still less can the flame *in the interior* of a Mongolfier balloon waver. To protect the cotton tissue of the balloon from sparks, it is quite sufficient and effective to saturate it with a solution of alum. The circumstances through which I lost my Mongolfier balloon, before it came into my possession, are not worth detailing. It was seized at the Turin custom-house as English cotton goods. I, however, made a smaller one myself, by experimenting with which I have arrived at the above conclusions; but shortly having other things to attend to, there ended my ballooning project. But if any one would now be at the expense of constructing such a balloon, I should be very happy to furnish him with my *modicum* of knowledge and assistance on the occasion, and be the first to make a demonstration of *that which I conceive to be the best method of ascending and passing through the air by means of a balloon.*

Marshal Jourdan was commander-in-chief of the French army in Flanders when a balloon was made available to the taking of all the plans of the enemy's lines. I have conversed with him at length on the subject, and he allowed that a Mongolfier might be constructed, filled, elevated, and applied to all such purposes, when it would be impracticable to procure hydrogen gas, or a balloon sufficiently impervious to retain it. The Mongolfier requires no varnish. Gas escapes through all those hitherto applied.

Almost the only useful purpose to which I could think of applying an hydrogen gas balloon would be the establishment of a communication between a stranded ship and a lee-shore. About three years ago I addressed you a letter on that subject, but I cannot say in what Number it appeared. I gave you a detailed description of the apparatus required. The Portable-gas Company compress thirty volumes of gas into one, into vessels of thin sheet-iron with ovoidal

ends. Such a vessel charged with one hundred cubic feet of the best gas, might easily be fitted into the bottom of a large cask. The empty balloon being placed over it, and communicating by a tube and stop-cock. In the same cask might be arranged a long cord of the lightest and best materials. The whole apparatus, properly made and packed, would always be ready on deck like a mere water-cask. The balloon once up, by adding more rope to the thin one belonging to it, must come at last into contact with the edge of a cliff, or with the surface of any lee-shore. The balloon might also be made to take up a small grappling, composed of three or four shark-hooks tied back to back. I fear, however, that there would be considerable risk of the balloon's being torn by the yards, &c. of the ship before it could be got clear of it. In the case of a low coast without cliffs or high rocks, an empty water-cask, protected by sacking, &c. would take a line on shore as well as a balloon. Apropos of water-casks and provision-casks, I have suggested many years ago, that if, as these become empty, they were to be bunged up and stowed so as not to be washed away, their buoyancy would prevent the vessel from sinking even when she were full of water. All the trouble is in well bunging up the casks when they become empty.

Yours, &c. F. Maceroni.

September 10, 1836.

MR. GREEN'S ACCOUNT OF THE ASCENT OF THE GRAND BALLOON FROM VAUXHALL.

The inflation of the balloon commenced at 10 minutes past 11, on Tuesday, September 9th, and in the space of 12 minutes it possessed sufficient power to support itself. Thirty-six men of the Lambeth division of police were then placed around, each taking charge of one of the cords connected with the network. In about an hour an iron weight of 56lb., provided for the purpose, was also attached to each cord, and shortly after five more at different parts, making in all 41 weights of 56lb. each. These were soon all lifted three feet from the ground, and the policemen were obliged to pass their staves through several of the meshes to prevent the cords cutting their hands. This enormous combined resistance was found insufficient, and 20 of the workmen in the gardens were called to the assistance of the police. The rain now fell in torrents, and the netting and silk must have absorbed at a moderate calculation 300lb. weight of water, besides the quantity retained on the top of the balloon by the pressure of the net on the silk, each mesh forming a small reservoir. At a quarter past four the inflation was completed, having occupied, and under these unfavourable circumstances, only five hours and five minutes. I had supposed five hours would have been the time required, but I now believe four would be sufficient on a sunny day. The process of attaching the car to the net was commenced, and, from the shrinking of the ropes by the wet, and the necessary adjustment required at the first ascent (which cannot be done until the balloon is inflated), was I fear somewhat tedious to the company, but the ropes being now cut to the proper lengths, this will be for the future effected very quickly. Twenty-four bags of ballast, weighing together 400lb., being placed in the bottom of the car, my companions, with the greatest alacrity, obeyed my summons, and took their seats; they were Mr. Hildyard, Captain Currie, Mr. Holland, Mrs. Green, Miss Green, Mr. E. Gye and Mr. W. Hughes (sons of the proprietors), and Mr. James Green, my brother, making in all nine persons, myself included.

I had calculated the power of the balloon according to the average specific gravity of the gas made by the different companies, and found it to be considerably more than has been stated in the advertisements; but it was the wish of the proprietors and myself to underrate, rather than overrate, its capabilities, in order that the public should in no case be disappointed, but, on the contrary, unless some unforeseen circumstances occurred, be surprised. However, owing to the exertions made by Mr. Hutchinson, engineer to the London Gas Company, and his judicious arrangements in the manufacture of the gas, even my own expectations were surpassed, and I was obliged to allow about 15,000 feet of gas (equal to one-fifth power of the whole) to escape before I could release the machine from the moorings, the ascending power being much too great, and no room being left in the car for many more passengers.

We proceeded at first to the east, but soon took a south-easterly direction, leaving Greenwich and Woolwich to the left. The gardens, and every avenue leading to them appeared to be one solid mass of human beings; in fact, there was not an elevated spot within two miles of the metropolis which was not crowded with spectators. We had ascended about three quarters of a mile, when we found ourselves in a brilliant sunshine, which formed a strong contrast to the dense and clouded atmosphere we had just left. The gas now expanded rapidly, and the silk down to the bottom of the neck was completely distended; we, of course, ascended with great velocity, and in less than five minutes the fall of the mercury in the barometer indicated a height of two miles and a-half. This was our greatest elevation, and, it being nearly dark, I thought it unadvisable to ascend higher; therefore, suffering a small portion of gas to escape from the valve, we commenced our descent. We were now nearly opposite Gravesend, and had crossed the Thames several times: the grappling iron or anchor first touched the ground near the village of Cliffe, in Kent, and after slightly catching several times, took a firm hold; a slight breeze springing up at this moment, the jerk caused the hoop, to which the grapple cord was attached, to give way, which rendered it necessary to open the valve very wide. This done, the car soon touched the ground; we then drifted about 100 yards, and, the valve being kept open, the stupendous machine, which so lately exhibited its giant power, lay motionless on the ground.

All my companions expressed the greatest delight during the voyage, and enjoyed themselves much; indeed, so loud was their mirth several times, that I had some difficulty in making my directions audible, for I assigned a duty to each, suchas watching the rise and fall of the mercury in the barometer, and thermometer throwing out ballast, &c. Being forced to take such a large quantity of ballast, we found the too small, but a new one much larger car will be constructed for the next ascent.

We slept at the village of Cliffe, proceeded to Gravesend yesterday morning, and arrived in town at 10 o'clock last night.—*Times.*

THE HOUSE-BURNING SYSTEM.

The immense amount (between 400,000*l.* and 500,000*l.*) of property destroyed at the late fire in Tooley-street—about 100,000*l.* of which falls upon the Sun Fire-office alone—may perhaps cause some energetic efforts to be made for the employment of more efficient means than have been hitherto adopted either of putting out fires or of arresting their progress, if not of preventing them altogether. The effect of the system of fire-insurances, like that of the Drowning at Sea Society, has been to perpetuate the evils it was intended to avert: individuals are secured from pecuniary loss, but burnings and drownings continue. With such a vast amount of capital, and so many practical men engaged in the business of preventing and repairing damage by fire, it is surprising that in the present improved state of mechanical science no mode should have been discovered of extinguishing a burning house. Our engines *do not put out fires*, but only keep them from spreading, with the aid of party-walls: where these are wanting, the only preventive means is to isolate the flames by pulling down adjoining buildings. We laugh at the Turks, who suffer whole streets of houses to be burnt down, and then quietly build them up again of the same inflammable materials; but we are not much wiser in our generation. Our buildings are not quite so quickly destroyed by fire, but they are scarcely less easily set light to, and their ultimate destruction is hardly less certain. Cast-iron beams and columns and stone-staircases may be employed, but there is enough wood used in the construction of buildings to carry the fire from room to room and from floor to floor; and the shell of brick that remains is only a dangerous ruin. Surely some plan of building might be adopted, by which a fire breaking out in any one apartment would be confined to it. This, however, is an ulterior consideration: the more immediately important point is the means of extinguishing fires that break out in buildings as at present constructed. Every one must have been struck with the absurdly inadequate powers of our fire-engines: it would be ludicrous, were it not a melancholy sight, to see a score of men panting and toiling to squirt a tiny stream of water on to a blazing house—it rather augments than helps to quench the flames: a dozen such jets playing at once can produce very little effect on a great body of fire; the immense heat converts the small quantity of water that comes in contact with the flames at one time into gas that adds fuel to them. The utmost that the best-served engines can do to stop the progress of the fire, is by saturating the adjoining buildings with water, or quenching parts partially ignited, or half burnt out: to quell a body of flame such as a

house on fire presents, is beyond their capability.

The stream of Braithwaite's floating-engine on the Thames is about the bigness of one's arm, and it is said to throw up a ton of water a minute:* here, then, we have an engine of efficient power; but it is only available in cases of fire near the river-side, and then not at low-water,—which was the cause of its not rendering such good service at the fire in question. Deficiency or delay in the supply of water is the common complaint at all fires; and the water-companies also complain of the enormous waste of water, which they allege to be the cause of the deficiency, though it cannot be of the delay. The quantity of water suffered to run down into the sewers, is doubtless more than is used in checking the progress of the flames. Surely there are other methods of supplying an engine with water than by flooding the streets? A pipe screwed on to the main, having branches communicating with the hose of several engines, would convey all the water withdrawn from the reservoir on to the fire; and such an increase of propelling force might be supplied as would project a greater volume of water to the requisite height. Steam power is at present the most available for this purpose; and we used to hear mention made of a steam fire-engine, which performed wonders. What has become of it? The efficacy of a stream of water less than six inches diameter seems to us to be inadequate to the quenching of a mass of fire: if a whole cistern of water could be raised to the requisite height and overturned on the flames, a few repetitions of such a dose might suffice to extinguish them at once, with less labour and a far smaller consumption of water than by the present mode. Should this not be practicable, however, the column of water propelled by the engines ought at least to be greatly increased; and some mode adopted for preventing the waste of water, and securing a prompt supply. When the fire-insurance companies suffer so largely as the Sun is reported to suffer, we may reasonably expect that the Directors, looking to their own interest, will cast about for some better protection from loss, which will benefit the public generally. The first step to an improvement of the fire-police has been effected by adopting the principle of co-operation: it now remains to put an efficient mechanical power into the hands of the Fire Brigade.—*Spectator*.

* The writer labours here under some mistake. Mr. Braithwaite has no floating-engine on the Thames; he did submit to the associated fire-offices the plan of one which would have thrown, not a ton, but a ton and a half of water a minute—to a height of some seventy or eighty feet—but *it was declined, for reasons which we must leave the gentlemen whose characters are implicated by the refusal to explain*.—Ed. M. M.

HINT WHICH WILL BE USEFUL WHEN (?) MAGNETIC LOCOMOTIVES ARE IN USE.

Sir,—I observed in your last monthly Number, among the "Notices," that Mr. Mullins, M. P. for Kerry, was constructing a locomotive-carriage to be propelled by the power of electro-magnetism. If he generates his power by means of the action of diluted sulphuric acid on alternate plates or cylinders of copper and zinc, hydrogen gas is rapidly evolved, which I should advise him to save for the purpose of lighting up the carriage if intended for night travelling. And, again, the zinc and the copper decomposed by the action of the acid would be converted into sulphate of zinc and sulphate of copper, which, if formed in a considerable quantity, would be well worth extracting, and go a long way toward paying the expense of a new generator.

I remain, Sir, yours obediently,

Tyro Mechanicus.

Chacewater, Sept. 13, 1836.

AVERY'S ROTARY STEAM-ENGINE.*

The re-invention in America of Hero's engine, and the application of so old a principle in the power of steam to useful purposes, has created some stir on this as well as on the other side of the Atlantic. In both the old and new countries have the statements put forth by its re-inventor, Mr. Avery, been met with disbelief and an unfavourable prejudice. These obstacles, however, seem to be gradually diminishing in America, where the engines are becoming, by a sort of reaction, great favourites; according to the *American Railroad Journal*, "the demand for them is greater than can be supplied, by the constant labour of one hundred men!" One is about to be shipped for the government of Russia, and another for the government of Prussia. Will not some engineer put the thing to a working test in England? From the above-mentioned source (into which they are copied from a pamphlet), we abridge the following testimonials in its favour. In the *Railroad Journal*, copies of the letters are given verbatim; they have a genuine appearance, and are from known persons, and as such we are

* Described in No. 637.

bound to give credence to the statements contained therein.

After describing the rotary engine as working a saw-mill, it is said that,

"Saw-mills of this description are in common use in the western and south western states, driven by Avery's rotary engine, which is now coming much into use, for flouring and saw-mills, cotton-gins, and other purposes, as will be seen by the accompanying extracts of letters to Judge Wilkeson, of Buffalo, who has the agency west of the Lakes and Alleganies. These are only a few of the very numerous letters, which might be published, commendatory of the engine; yet they are, with others herewith given, sufficient to place it in its proper light before the community.

"A candid perusal, and unprejudiced examination of the engine, will satisfy those who desire to be convinced. This engine speaks, by its *silence*, its own praise, to those who witness its operation.

"The gentleman, Mr. Kinney, who wrote the letters from which the following extracts are made, resides at Louisville, Ky., and has a *machine-shop there*, in which the first rotary engine was put up west of Pittsburgh. The engine operated so much to the satisfaction of Mr. Kinney, and his partner, that they undertook the putting up of engines in the south western States.

"It will be observed, that it was with difficulty introduced into use, in the south-west, as there were but *few* who dare trust their *eyes* when its operation was so directly in the face of *previous theories*, and especially whilst every machinist and man of science *opposed* it."

The principal facts mentioned in Mr. Kinney's letters are as follows:—On the 15th of August he put up an engine for Messrs. E. Grover and Co., of Richmond, which he left in complete and successful operation. He says, "I met with no difficulty the first time I raised the steam in making the engine operate to the entire satisfaction of its owners, and the admiration of multitudes who came to see the far-famed rotary steam-engine." On the 23rd of September, he acknowledges the receipt of three engines. One of these, a large one (he does not state the size), he put up at a mill at Shelbyville; and on the 28th of the same month he writes as follows:—

"The mill at Shelbyville operates admirably well; I put up the three 18-inch boilers which I received from Pittsburgh, and find that there is a superabundance of power to drive two pair of 3½ feet stones, so as to grind wheat or corn, well and fast. I remained two days after they commenced grinding, and left every thing operating to the entire satisfaction of all. Mr. Dupuy was much pleased with the engine, and unhesitatingly paid 400 dollars, and gave good security for the remaining 500 dollars.

"Having all my machinery ready to drive the stones by bands when your plan arrived (to drive them with gear), I could not, without much expense and delay, make the alteration. The large wheel is six feet, its shaft is nine feet long, upon which is a drum, and from which drum-bands pass to pulleys on the spindles which drive the stones; bands also pass from the drum to drive the force and cold water pumps, elevators, bolts, screen, fan, and hopper boy, all of which perform their office well and sufficiently fast to convert 10 *bushels of wheat per hour into flour*."

On the 13th of November, he acknowledges the receipt of one engine, and mentions the shipping of another. Having erected the former for a Mr. Henry, he says,

"Mr. Henry's engine is in successful operation. He is fully satisfied with its performance, so far as he has had an opportunity of testing it. * * I have put two run of 3½ feet stones in operation for him, and believe the power is sufficient for three run of 3½ feet, or even 4 feet. I put up three boilers 20 feet long and 22 inches diameter, say exactly by that size. More pains should be taken to have the large engines accurately balanced, and the pulley also should be put on the shaft before the arms are, and exactly balanced—if the pulley is not balanced, it produces a vibration between the end of the shaft and the centre, against which it runs. I am more pleased with the operations of all parts of *this* engine than any rotary I have yet put up; and I believe it will be so managed, by those who have the care of it, that it will continue to perform well. * * The stones have 135 revolutions per minute, and grind at the rate of seven bushels per hour."

In February, in the present year, Mr. Kinney states,

"I have put in operation for Judge M'Ghee *two* cotton-gins and one pair of mill-stones 3½ feet diameter, and I find that the engine has an abundance of power, although I have been under the necessity of using very poor wood, but have no doubt that if I had another cotton-gin to put on, it would drive the *three*, with the mill. The boiler is 23 feet long, and 26 inches diameter. I expect to attach to this engine a saw mill-saw, as

the power is sufficient. This engine has three feet arms."

In various letters, engines are spoken of favourably, as working at different mills, upon a railroad (of which no particulars are given), and in a boat. Certificates also, with numerous signatures, attest its successful operation; that it is the best engine for milling purposes,—the easiest of management, &c.; and this after two and three years experience of its working.

Messrs. Lynds and Son, of Syracuse, engine manufacturers, having put up one for a saw mill, for a Mr. N. Felt, addressed to him the following queries:

"1st. Have you made any alterations in your boiler, in any form or manner, since putting the rotary in use, so as to afford more steam with less fuel?

"2nd. Is there any difference in the amount of fuel required to perform an equal amount of labour with either of the engines? If so, which requires the least, and what is the difference in the quantity used?

"3rd. Does the rotary engine do more or less work, in the same time, than the piston engine? What is the amount of difference?

"4th. Which engine do you conceive to be the most simple in its construction, and in its application to any mechanical purpose the most natural? Also, which is kept in repair with the least expense?

Mr. Felt returned the following Answers:

"In answer to your first question, I would say I have made no alteration in my boilers or arches.

"2nd. As to the amount of fuel required, I am not able to answer precisely, but am sure the rotary does not require more than two-thirds the quantity to put it in operation the piston engine required.

"As to the amount of the business performed, the rotary will do double the amount of the piston engine in the same time. So far as I am acquainted with the two engines, I consider the rotary the most simple in its construction and application to mechanical purposes, and I think is kept in order with the least expense. With the experience I have with the two engines, I should prefer the rotary for any mechanical purposes whatever."

Dr. Jones, the editor of the *Franklin Journal*, to whose pages we are so frequently indebted, and in whose judgment we place great confidence, gives some very favourable testimony in relation to Avery's engine. We subjoin what he says, therefore, as an answer to the various correspondents who have asked us for further information, or our opinion, upon the subject. The remarks appended are from the *Franklin Journal*, and are given in answer to a correspondent signing "Fair Play":—

"It so happens that 'Fair Play,' and others, who desire information on the subject of Foster and Avery's re-acting steam-engine (commonly called Avery's), will, in the present number,* have a full opportunity of seeing what constitutes the claim of these gentlemen to a patent for an improvement in this machine. They were fully informed respecting what had been attempted with engines similar in construction to their own, previously to their obtaining a patent; and it will be seen that they have confined their claim to improvement within very narrow limits, and so far as we are informed, their claim is a valid one. It may be said that their improvement is trifling; that, however, is their own concern, as those who do not need it are at full liberty to use the machine in any of the various forms which had been previously given to it, or to devise others which are new, without buying from them what may be deemed unimportant.

"We are not sufficiently well informed respecting the comparative results obtained from Avery's and the reciprocating, or Avery's and other rotary engines, to make up our minds respecting its real value. Between four and five years, however, have elapsed since this engine was patented, and it has been at work at Syracuse, and various other places, during the whole of that time, so that those who have seen it, and who possess a competent knowledge of the subject, have had time enough to investigate it. Before the patent was obtained, we expressed to Mr. Avery our general want of confidence in the real value of such engines, and our doubts respecting the importance of the improvements claimed; and we did not suppose that the career of the one in question would extend to two years; a length of life greater than has usually fallen to the lot of rotary engines; it still lives, however, maugre our anticipations, and all the reports which we have received relating to it, tend to show that it has not yet exhibited the first symptoms of decline."

The following extract from the specification shows the claim of the patentees:—

* See extract from the specification annexed.

"We find it to be a point of great importance to give such a form to the revolving arms, as shall subject them to the least possible resistance from the air; we therefore, instead of making them in the form of round tubes, which has been heretofore done, give to them the form which results from making each half of the arm a segment of a large circle, so that, when the two halves are united, the edges of the tube present acute angles. The tubes, however, may be made elliptical, or oval, and the same end will be, in a great measure, attained. We use any number of such arms on the same shaft, as we may find best adapted to our purpose.

"We do not claim to be the inventors of the re-acting steam engine, nor of the case, or drum, within which we intend the arms shall, in general, revolve; but what we claim as our invention, is simply the giving the oblate, or flat, form to the revolving arms, so that, in proportion to their capacity, they shall experience much less resistance from the air than that to which they have been heretofore subjected, thereby obtaining a greatly increased power."

"In several articles published in other papers alluding to 'Avery's rotary-engine,' *information* has been asked for; and in order to give an answer as satisfactory as possible, I made personal examination and frequent inquiry of gentlemen of intelligence and character in this city, who are perfectly familiar with the *daily* operation of one of them with 30 inch arms, or five feet sweep, and thei followng is the result of my investigation; and for its correctness I can give the most satisfactory testimony if desired:—

"The engine alluded to is now, and has been for several months, in operation in Attourney-street, in this city—where it has been visited by hundreds of intelligent gentlemen, who have been not only delighted, but astonished at its performance—and especially with its *quiet* and *modest* behaviour—if I may so speak. It is not uncommon for gentlemen unacquainted with its appearance to go into the engine-room at the *Astor House*, where there is one of eight-horse power, after looking at the *boiler*, *pump*, and *machinery*, *inquire for the engine*—notwithstanding they may be within a few feet of it in full operation. There is nothing in its *appearance* which indicates a *steam-engine;* and in the cost of *repairs* and *attendance* there is very little more resemblance.

"It will be observed, that a statement is given in the following extract from the (*American*) *Mechanics' Magazine*, of *the quantity of water evaporated;* and it may be proper for me to say that that result was arrived at after repeated and frequent measurements—I may also say that the result has since been even more satisfactory—the work having been done *with an average of* 35 *gallons of water per hour*—a result *very* different from what is *usually* estimated to be required for a piston engine. The estimate is, if I am not in error, from 7 to 9 *gallons per hour per horse-power.* Allowing these statements to be correct—and they are susceptible of the most satisfactory proof,—it does not require very profound wisdom to arrive at the conclusion that *a less quantity of fuel, as well as of water, is used for the rotary than for the piston engine.* Should it be also found, on inquiry, that the *economy* is *equally great* in the *first outlay* and in the *cost of repairs* and *attendance*, as it appears, by the above to be in the use of *water* and *fuel*, there can be little doubt of its coming, and immediately too, into general use. That such is the fact I am prepared to show to those who desire farther information.

"The arms of the engine are 30 inches long from the centre of the shaft to the apertures, and the apertures are each the $\frac{1}{16}$ of a square inch—they are enclosed in a circular cast-iron case—the shaft receiving the steam at one end, and having a pulley for the main band on the other.

"The following machines are all attached to, and operated by it, viz.:—

"1 upright saw with 30-inch stroke, or 15-inch crank—averaging 110 strokes per minute.

"1 buz saw, 24-inch, cutting a kerf of $\frac{3}{16}$ of an inch, with 22 to 2400 revolutions per minute.

"3 24-inch circular veneering saws.

"1 26 " " " "

"1 27 " " " " varying from 12 to 1500 revolutions per minute.

"1 15-inch buz saw, with 1200 revolutions per minute; and

"1 whip saw for curves, with 9-inch sweep and 250 strokes per minute.

"1 grindstone.

"1 blower for the furnace.

"And the pump raising water 30 feet into a reservoir for its own use.

"These machines are not *always* all at work at the same time—as some of them require repairing, or filing, or they are taking off or putting on logs; but this may be said without fear of contradiction—they *can* all be driven at the same time by the engine now in use, for 10, 12, or any number of hours that the superintendent and hands can tend it; and that, too, with the evaporation of an average *not to exceed* 40 *gallons of water per hour*.

"The boiler now in use was made for a

piston engine, and was intended for 15-horse power.

"It has been asked, and frequently, what is the power of this engine. This is a question easier asked by many than answered—yet most practical men form an opinion for themselves of the power required to carry this machinery—and it is, of course, in this way, estimated variously.

"It cannot, however, be put down at less than the following estimate, viz.:—

	Horse Power.	
The upright saw, sawing 110 feet per hour	5	5
The large buz saw, sawing 120 feet per hour	5	5
The small do. do. . . .	1½	1½
The veneering saws	1	5
The whip-saw, grindstone, pump, and blower		1½
		18

"But to avoid over-estimates, we will put the whole at 15-horse power, to accomplish which 40 gallons of water were evaporated at an expense of fuel of *one dollar* for every ten working hours, and 1 dollar 25 cents for attendance on the engine and fire.

"It should be borne in mind that these saws are all used in sawing mahogany—except the whip-saw, which is used for sawing all kinds of timber.

"In addition to the above, a turning-lathe is to be put in operation in a few days."

The following letter we extract in full on account of the interesting particulars it contains, with respect to the mode of operation in obtaining gold from the ore, as well as in relation to the engine. The writer is a Mr. Harris, superintendent of a gold mine, of Charlotte, Mechlenburgh Co., N. C. The letter is dated July 12th, 1836, and is addressed to Mr. Minor, of the *Railroad Journal*:—

"Your note containing questions respecting the rotary engine has been duly received, therefore in compliance with your request I transmit to you the following answers:—

"1st. The diameter of the engine, or length of arm, is 5 feet.

"2nd. Its estimated capacity or power, was considered by the maker to be equal to twenty horses, which power it has generally performed since it has been in full operation, so considered by myself as well as others employed at the establishment. I am not prepared to say what power the engine would be, by an additional pressure of steam, but the highest pressure used by us, never exceeds 100 lbs. per square inch in the boilers, and frequently not over 80 lbs.

"3rd. The machinery and apparatus used are of a very complex character,—*six Chillian mills, two Arrestres, one Hungarian washing-machine, four shakers* (making two sets of shaking-tables), and *one pump* of six inches diameter, 110 feet in length, are the various kinds of machinery used and set in motion by the rotary engine. Perhaps a brief description of the nature of the machinery will better enable you to judge of the power required to propel such machinery. The Chillian mill is much on the same principle as that of a Bark mill; consisting of a large stone 6 feet in diameter, and 14 inches thick, which is made to revolve in a vertical position in a circle of 4 feet diameter, which circle is enclosed by staves in the form of a tub, and made so as to contain water; the ore is therefore regularly deposited by means of a shovel under the vertical stones, which revolve, crush the ore, and pulverise it to a powder, when it is carried off, by a constant stream of water passing through the tubs. Much depends on the attention paid, and the character of the ore ground in this kind of mill, as respects the power required to propel them. At our establishment they have always been considered equal to one and a half horse power each. The Arrestre mill differs in its construction and mode of operation from the Chillian mill. It consists, in the first place, of a large bed of solid granite rock, generally about 9 feet diameter, and from 12 to 18 inches thick, encircled by staves which form a complete tub, in the centre of which is placed a perpendicular shaft, and through which, about two feet from the bottom of the tub, pass two horizontal arms, extending the diameter of the tub; to these arms are suspended from four to six large rocks that will generally weigh from 200 to 300 pounds each, when the whole is set in motion by gearing-wheels from the top, and propelled to the speed of about ten revolutions per minute, and the ore mixed with water is pulverised to the consistence of paste. This process, as well as the one described above, depends much on the manner in which it is treated, and the character of the ore, as respects the power required, which has been considered at our establishment equal to 3-horse power each mill. The other apparatus used for washing, &c., require but little power, and therefore need no description. The pump is calculated to raise about 67 gallons of water per minute, with the present number and length of stroke, which, together with the washing apparatus, is considered to require about 5-horse power, making altogether, according to calculation, 20-horse power.

"4th. The engine, since its erection, has been kept in constant operation, Sundays and accidents excepted.

"5th. When in full operation, as all the

machinery has been for four months past, three cords of wood has been found sufficient to raise steam enough to carry the whole machinery 24 hours.

"6th. The quantity of water evaporated *per hour*, as near as I could ascertain, when in full operation, has been about 60 gallons.

"7th. The engine was first started about the beginning of Sept. 1835, and continued to work the pump and four mills only, until March, 1836, at which time the whole machinery was attached, making altogether nearly 10 months.

"8th. The cost of repairs has been very trifling, the whole expense of repairs, that could properly be said to belong to the engine during the whole time, will not exceed ten dollars.

"9th. With careful attention it is not liable to get out of order.

"10th. The cost compared with a piston engine of equal power will not, I presume, much exceed one-half that of the piston engine.

"11th. If I was in want of another engine of about 20-horse power, I would certainly prefer the rotary to the piston engine.

"In conclusion, sir, after answering your several questions, permit me to state, that in my opinion the rotary is preferable in many respects to the piston engine. It can be attended by persons of less skill, is less expensive in transportation, and less expensive in erection than engines generally of the piston kind."

In all the foregoing testimonials with respect to Avery's engine, there is great want of that particular evidence, which is required in England, to establish the superiority of one kind of engine over another; it is all too vague and general —all calculation upon established rules and good data has been avoided. We acknowledge, that in America (for which, indeed, it is intended) the evidence given will have, perhaps, more effect than any founded upon calculation — engineers being there but little accustomed to look beyond the surface of matters. But here, instances must first be shown to be founded on general principles, before they will be received. Work must be shown to tally with calculation, and calculation with work. We would recommend the American patentees to put up an engine of their best manufacture, as a sample machine, and submit it to some such trials as Austen's steam-engine underwent (see our 643rd Number). When we hear the results of such a trial, we shall be better able to give an opinion.

THE NEWTONIAN THEORY OF THE TIDES.

Sir,—My old acquaintance, Ursa Major, tells us that he is "sufficiently read in mathematical science to discern that where there are half a dozen different demonstrations contradicting each other, they cannot be all true." I do not know what meaning Ursa Major attaches to the word *demonstration*. I always thought that a demonstration was meant to prove the truth of a proposition, so as to render it a matter of certainty; in that sense to speak of demonstrations contradicting one another, would be repugnant to common sense. But are you sure, friend Ursa Major, that your knowledge in mathematical and physical science is such, that when you read two authors on the same mathematical or physical subject, and find them to disagree, you can determine which of them is right (supposing one of them to be so); or supposing one of them partly right and partly wrong, could you separate the chaff from the corn? I am afraid you could not; or if you could, you surely never read with attention that passage you have quoted in your last letter in the *Mechanics' Magazine* from the writings of Dr. Wilkinson, which you seem to imagine will set the matter in dispute in a fair point of view. Newton is to be compared with Dr. Wilkinson! What next? Sir Henry Halford, I suppose, with Dr. Eady. But let us see what sense we can extract from this selected passage that is to set the matter in dispute in a fair point of view.

"Supposing (says Dr. Wilkinson) the mean distance of the moon from the earth to be sixty times the radius of the earth; and if the law of gravitation be assumed, according to Newton, as diminishing as the square of the distance increases, it will be evident that 60 multiplied by 60 being equal to 3600, will express this proportion, viz. that 3600lbs. on the surface of the earth removed to the *moon's surface* would only weigh 1lb. (!)" So says the learned Dr. Wilkinson, and so believes his enlightened constellate, Ursa Major. But in opposition to such mighty authority, I (Kinclaven) assert, that Newton never maintained nor ever dreamed of such a thing. Newton has demonstrated, that if a body is placed at any distance above the surface of the earth, the gravity or weight of this body diminishes in the inverse ratio of the

squares of the distances; and the only force, he assumes, that acts upon this body, is the gravitation of the earth itself. But let us suppose that the learned Doctor is right, and that the body only weighs 1lb. when placed on the surface of the moon, then the force of gravity at the surface of the moon will evidently be $\frac{1}{1800}$ of that at the earth's surface, for the body is then acted upon by two opposite forces, the one being $\frac{1}{1800}$ and the other $\frac{1}{3600}$ and $\frac{1}{1800} - \frac{1}{3600} = \frac{1}{1800}$. The Doctor assumes the radius of the moon to be $\frac{2161}{2}$ miles $= 1080\frac{1}{2}$, hence 240,000 (the distance between the centres of the earth and moon), divided by $1080\frac{1}{2} =$ 212, that is, the distance between the centres of the earth and moon is 212 times the radius of the moon; hence $\frac{1}{1800} \times \frac{1}{(212)^2} = \frac{1}{56899200} =$ gravitating force the moon exerts at the surface of the earth. Again, the Doctor assumes the mean depth of the sea to be 4 miles $=$ 253440 inches; hence (still following out the Doctor's plan) $\frac{253440}{56899200} = \frac{1}{224}$, that is, the gravitating force of the moon will only raise the sea $\frac{1}{224}$ part of an inch! It is true, the Doctor contrives to make the height of the tide 6 feet; but let it be remembered, the Doctor assumes that the moon exerts one-half the force of gravity at the earth's surface to what she does at her own surface!! Whereas I have supposed (taking Newton for my guide) that the gravitation of the moon follows the same law as that of the earth, namely, the inverse ratio of the squares of the distances. But enough of this part of the Doctor's nonsense.

The Doctor then proceeds to find the centre of gravity between the earth and moon, assuming the distance between their centres $=$ 60 semi-diameters of the earth, the moon's diameter 2161 miles, *their mass* in the ratio of 49·22 to 1, and *the density of the moon* to the density of the earth as 11 to 9. Here the Doctor, forgetting his former statement, now makes the density of the moon (comparing equal bulks) greater than that of the earth! He calculates the ratio of the distances of the centre of gravity from the centres of the bodies to be as 39·788 to 1; and that the centre of gravity is 5880 miles from the centre of the earth. But the data is far from being correct, and the answers from that data are wrong; so that the Doctor's knowledge in the simple rules of arithmetic seems to be on a par with his physical attainments.

Ursa Major says he asked me for an explanation of the paradox of the tides, &c. I have already told him that there is no paradox in the matter, and that hundreds of explanations and demonstrations have been given of it—from the humble explanation of Ferguson to the profound researches of La Place. So that it would be an act of supererogation to give an explanation or demonstration of that (unless I could do it in a simpler way) which has already been given by so many. If he is unable to follow their demonstrations, it is his own fault; he might just as well ask me to give him a demonstration of the 47th proposition of the 1st book of Euclid, because he could not understand that given by Euclid, and for this reason, too, that he could not be troubled to read the whole of the propositions upon which the proof of the 47th depends. We should have lots of profound mathematicians, too, if it was not for that great bore of learning, the multiplication-table. Indeed, Ursa Major, from your last letter it appears you ought to take a spell for some time at the "Tutor's Assistant," and let physical science alone until you are better prepared to enter upon the study of it.

I am, Sir, yours, &c.

KINCLAVEN.

OBSERVATIONS ON MR. EXLEY'S NEW THEORY OF PHYSICS.

Sir,—The following paper, containing observations on "Mr. Exley's new Theory of Physics," was written soon after that gentleman's reply to some former strictures of mine on the same subject, but has been delayed in consequence of my wish to append to it an examination of the validity of the distinction between the primary and secondary qualities of mat-

ter. An arduous profession allows me little leisure for such pursuits, and the subject is difficult. So much time therefore elapsed, that though I continued the investigation, having another object in view, yet thinking all interest in Mr. Exley's theory must have ceased, I long since gave up the intention of sending you even any portion of my paper. Mr. Exley, however, having again brought his theory before the public, through the medium of the British Association during its late sittings at Bristol, I am induced to revise my opinion respecting the propriety of resuming the discussion, for though this communication is out of date, in a controversial point of view, yet the general subject is of no fugitive character; and the theory itself is likely to have a permanent interest attached to it, by the very favourable manner in which it was received by Doctors Dalton and Thomson. I shall not, however, enter on the abstruse inquiry alluded to above, but merely subjoin my view of some metaphysical consequences which must result from Mr. Exley's physical doctrines.

It is announced that Mr. Exley has brought forward in favour of his hypothesis some fresh facts in relation to the specific gravity of the gases. If these instances of verification do not rest on principles, data, and results, which run in a circle, and acquire merely a mutual, self-derived support—if they are upheld by collateral and independent proofs, and by a course of reasoning untainted by subsidiary hypothesis—I shall receive great satisfaction from the circumstance, for my prepossessions are entirely in favour of Mr. Exley's theory; and I shall be eager to congratulate him on his having verified it, though but in part, after that more satisfactory and unexceptionable manner, the necessity of which is pointed out in the following paper.

I am, Sir, yours truly,
Benjamin Cheverton.

Sir,—In the review which I took of "Mr. Exley's new theory of physics," I was sincerely desirous of forming an impartial estimate of its merits; and I cannot think I failed, because I felt called upon to moderate in some degree the expectations of its author. I wished, also, to embrace the opportunity of making some general observations on that, or any other theory of physics, which, like it, should aspire to explain all the phenomena of inorganic nature, by deriving them from a supposed original constitution of the laws and qualities of matter. I thought it would be useful to notice the difficulties which in the present state of knowledge such an attempt has to encounter, and to examine the degree of evidence which, in the nature of things, such a theory is capable of receiving. I am sorry, therefore, that the observations in the reply with which Mr. Exley has favoured you should not have led directly to such an enlarged and philosophic discussion; that he should not have willingly engaged in throwing as much light as possible on these most interesting and important topics, with an especial reference, though it may be, to the corroboration of his own theory; that he should have thought it more advisable, or at least quite sufficient, in defence of that theory, to indulge merely in a running comment on what appeared to him objectionable points in my communication; and that the general tone of his remarks should imply, that I had not touched upon the more useful investigation alluded to, and had not applied the considerations which arose in the inquiry, as well for as against his theory, but that I had merely strung together a series of adverse observations or captious objections.

The most interesting point, as also the pivot on which the controversy turns, is the inquiry concerning the probability of Mr. Exley's theory being the true system of nature. If, without any doubt, the principles on which it is founded were what he asserts they are—certain ultimate *facts* or *truths*—still there would be room for a reasonable degree of scepticism, grounded on the possibility of some unknown principles affording, conjointly with the others, a more satisfactory explanation of phenomena. But those principles, wanting the character of axioms, and being avowedly advanced as postulates, he is not in a position to challenge so confidently the attention of scientific men to his *theory* as he otherwise would be entitled to do; and I fear that even as an hypothesis—plausible, ingenious, and elaborate as it must be allowed to be—it has not met with that reception which, from its extensive applicability, and the numerous accordances therewith of observations and experiments, it justly deserves. For it must be

in allusion to this theory, that Sir John Herschel observes, in his "Discourse on the Study of Natural Philosophy:"—"Molecular attraction has been attempted to be confounded by some with the general attraction of gravity, which all matter exerts on all other matter; but this idea is refuted by the plainest facts."*

In order to strengthen his position, that the first principles of his theory are undeniable physical truths, Mr. Exley observes, that "these principles are not arbitrarily assumed, but are themselves analytical deductions; and although named postulates, they are such only in a certain sense." It is also, I presume, *only in a certain sense* he would have us understand that they are "analytical deductions." Undoubtedly, it was from a review of the various phenomena of matter, that he was led in a general manner, analytically and inductively, and not arbitrarily, to fix on these principles as being of themselves sufficient on which to erect his system; but will he affirm, that he has entered on so pointed and definite an analytical investigation of any phenomena, as should make an inference of these principles therefrom, a necessary indubitable consequence. If so, let him publish it, by all means, and it shall have more weight towards the establishment of these principles, than any proof derived from the agreement of experiments or observations with deductions from them. Can he, for instance, bring forward any analysis which shall unequivocally indicate that the law of attraction between the atoms, to say nothing of the law of repulsion, is in the inverse ratio of the square of the distance. He will refer us, probably, to the heavenly bodies, asserting that "the voice of all their actions makes it appear that gravitation belongs to every atom of matter." This may be, but it is begging the question, if he would thence infer, that the *law* of molecular attraction is proved by the law of gravitation, for he must first assume that these forces are the same. He further observes, "Analysis carries us upward to the extended heavens, and downward to the *unextended centres* of atoms." Here, again, it is taken for granted, that because gravity attaches to the ultimate particles of matter, that it must extend to the *centres* of the atoms, pervading or constituting their very nature. Besides, independently of the law, the *quantities* of the forces in action between atoms and between masses may be different, for aught that any thing in the present state of knowledge can be brought to prove the contrary; and although this is not enough to affect the validity or the sufficiency of the fundamental principles of Mr. Exley's theory, it is sufficient to show that their existence cannot with any certainty be deduced from the universal existence of gravity. They may be *inferred* from various analogical and philosophical considerations; and that is the ground on which he should be content, for the present, to rest them, corroborated as they are by the evidence derived from the numerous accordances already referred to. It is quite in vain that he takes the high ground of insisting, that they are ultimate natural truths and facts, and it must be in vain, until the laws of atomic action have been more fully investigated by *experimental* research. He has made an effort to *anticipate* the natural progress of knowledge, and he must be satisfied accordingly with the position he has taken, and with having his system regarded as a not improbable hypothesis, to be kept in view in the future progress of science, for the purpose of having its principles established or refuted; and he should perceive, that in the mean time he is not entitled to claim attention to it as an undoubted and unquestionable theory. If it were such—if this distinction were conferred on it, as he contends it is, by my definition of a theory, namely, that it is "a system whose first principles are ultimate natural *facts* or *truths*, whether self-evident or analytically traced through a course of observations or experiments"—how is it that Mr. Exley's principles, if *facts* or *truths*, can admit of any doubt in any one's mind? How is it that only their fitness to explain phenomena is brought forward to justify our belief of their existence?

Then as to the law of repulsion—have we even as good a warrant for it as for the law of attraction? Do the experi-

* This hypothesis, however, cannot be so very absurd, or Sir John Herschel would not have bestowed any notice on it; he surely, therefore, might have referred us to a few of those facts which so plainly refute it. The truth is, that the assumption of knowledge on subjects of this kind, in so very confident a tone, whether it be in the way of affirmation or denial, is equally to be deprecated, as unphilosophical, and as unfavourable to the progress of discovery.

ments on compressibility countenance it? —but this discrepancy, it may be said, can be explained away on the *hypothesis*, however be it remembered, of the escape of ethereal matter. In order to avoid in some measure the too manifest appearance of the gratuitous character of this law, Mr. Exley would lead us to conceive of repulsion as being an inverted kind of attraction, and that therefore the law must needs be the same; "Gravitation," he says, "extends to the centre of atoms, while near the centre its direction is reversed." Besides unnecessarily complicating the hypothesis, in expression at least, how can we imagine that antagonist forces, although the law may be the same, can be identical.

It would be wrong to limit the progress of science, but it is not unreasonable to doubt whether discovery will ever reach to the primary laws of atomic action, in any very direct and satisfactory manner. Supposing Mr. Exley's conjecture to be true, that molecular and universal attraction is the same force, what an almost infinite distance apart on the scale of intensity must our inquiries be conducted, and how are we to connect them together, so as to acquire proof of the identity of the qualities investigated? What can we apply as a common measure to such wide extremes? A mountain is required to produce the slightest deflection of the plummet, and yet what an immensity of force do the phenomena of cohesion exhibit? Doubtless the atoms of matter, as every thing teaches us, are almost infinitely small; and this consideration presents us with a solution of the difficulty as a matter of fact, but at the same time it immeasurably adds to the difficulty as a matter of investigation and proof.

But let us admit that the first principles of Mr. Exley's system are unquestionable—let it pass for a moment as a *genuine theory*, we shall next have to ascertain whether it be a *true theory*, that is, whether there be a sufficiency in the principles, and a right mechanism in the process, from which and by which we are to work out all the results of nature. We are to ascertain whether this world of our concocting belongs to reality or to pure imagination. Every thing may be made out very plausibly, but are we certain that the phenomena can be explained in no other and no better manner? Are we assured that no other principles can possibly be implicated therein, than those which we have adopted, or that our *rationale* of nature's procedure is her true *modus operandi?* We want, as I said in my former article, the "*Instantiæ crucis*," of which Bacon speaks, "to decide the question by rejecting all the causes but one;" and I must again repeat, that "Mr. Exley has precluded himself from that more satisfactory analytical proof, by an exclusive adoption of the strict synthetical form." To which he replies, "this is said unadvisedly; a little thought would show that these principles are not adopted arbitrarily, but are themselves analytical deductions—they are the demands of nature herself—the very results of that more satisfactory analytical proof." No, no, I have not spoken unadvisedly, but with a perfect knowledge both of what I meant and of what I *said*. The truth is, Mr. Exley has not given sufficient consideration to the tenor of my observations, nor weighed sufficiently the import of my words. I did not then allude to nor speak of his principles as wanting the character of analytical deductions, though, as I have now shown, they, strictly speaking, are really not entitled to it; but I said that the system viewed as a whole—and not then questioning the principles on which it is founded—was in want of that more satisfactory *proof* which Bacon had described, and which I quoted; or, at least, that Mr. Exley had not advanced such proof in support of it. Admitting his first principles to be true—admitting they are what they are not—a legitimate analytical induction from phenomena—still, in reference to the system founded on them, proof is required that they alone are quite sufficient, and that they only are adequate to explain the processes of nature; and this proof is afforded, when, on an examination of all possible modes of accounting for things, the whole of them are rejected save one. This is the analytical *proof* (that was my word) of the validity of a *system*, and by implication of the fitness and adequacy of its principles. Now this proof is of course brought forward *subsequently* to the system being framed, but Mr. Exley has confounded it with the prior analytical induction of the fundamental principles, which equally, of course, must be advanced *before* the system can be framed; and because he has not distinguished be-

tween things so very different, he imagines, in spite of the import of my words, and of all contextual propriety, that when I am speaking and reasoning about analytical proof, I must mean analytical induction. In confirmation that this was the view which I was then taking of the subject, I may mention, that in order to illustrate my meaning I stated a few things which were necessary towards supplying this analytical proof, such as refuting the prevailing hypothesis of the undulatory nature of light, &c.

We must by no means imagine, because certain principles are fairly the result of an inductive investigation, that the truth of any system founded on them is therefore necessarily established. We may go further, and say, that this consequence does not follow, even if the principles are more than legitimate inductions—even if they are really found to exist in nature, for without being untrue, they may be insufficient to support so extensive a system as may be wished to erect upon them. Other unknown principles of co-ordinate value may really prevail in the natural system, which, after all, may not be quite so simple as in the artificial system, it may be convenient for the grasp of man's intellect to make it. Hence arises the necessity of testing the truth of a system, independent of, and apart from, its principles. If the system be found true, of course the principles cannot be false; but the converse will not follow, that because the principles are true, the system must be true also; for besides the truth of its principles, a true system requires a sufficiency in regard to their number, and an efficiency in regard to their character, by which they may be qualified fitly and adequately to meet the exigencies of all the particular cases. It is not enough to show that the principles do exist among the causes of things, for they may have only a concurring or a partial jurisdiction; it is necessary that they be not fewer than nature herself demands, for under the guise of simplicity in this particular, real complexity and circuitous procedures have been introduced into the working operation of systems, in order to bring the inapposite principles to bear in any manner upon facts. It is necessary also, that they be fully competent to carry all the *deductions* which are referred to them, *for even acknowledged* principles are not to be tortured and twisted to serve purposes to which they are really inapplicable. A system whose principles in their abstract truth are really not to be controverted, may still be very deficient therein, both as to their number and their quality, when they are considered in reference to their fitness for supporting a very extensive superstructure. I might also advert to the mechanism of the operations, or the form or mode in which the principles are brought into action, but this is a topic which I must pass. These things show, that to establish a system as indubitable, we must bring it as a whole to the test of a severe investigation, and to the strict analytical proof of rejection, by showing that the phenomena cannot happen in any other manner. We must have the *criterion instances,* which Bacon requires for the removal of all doubt on any subject, and which enable us "to decide the question by rejecting all the causes but one." We must prove in regard to the principles of the system, not merely that they are true, but that they alone are sufficient, and that they only are adequate to furnish the explanations of phenomena which are adduced. Am I exacting too hard a task? I did not before, nor do I now invite Mr. Exley to undertake it, knowing very well that in the present state of science it is impossible for him to accomplish it. I merely pointed it out to his attention, as that which, if successfully pursued, could alone justify his extreme confidence in the truth of his system. This task, however, must be undertaken—this proof must be produced before, in reference to this system, be it *theory* or be it *hypothesis,* it can be determined whether it belongs to the category of the things that are, or of the things that may be; but Mr. Exley, with the enthusiasm natural to him as the author of it, would forestall the favourable award of posterity. Instead of commencing with first principles of such extreme generality—so fundamental indeed that we presume on knowing the primal essential forces of matter—and thence with *à priori* reasoning, working downwards to phenomena, we shall do more wisely, at least for the present—at any rate we shall be more successful—if we work upwards with experiments and *inductive* reasoning, and restrain the imagination or genius from overleaping very many of the intermediates which connect

the known with the unknown. Some subordinate flights are admissible and useful, witness Dr. Dalton's, by which he alighted on the doctrine of definite proportions, but Mr. Exley's more ardent and impatient Pegasus, vaults at once to the primal spring and source of things.

Mr. Exley observes—"In the sixth head Mr. C. thinks the distinction of atoms into two widely different classes is not conformable to analogy; my head thinks otherwise." However that may be in regard to Mr. Exley's *head*, his hand it appears has not been induced by it to *write* much otherwise, for a few lines further on he says, "I think it probable that the electric fluid, which I have classed with the ethereal, may form an *intermediate* class, approaching that which constitutes light and caloric."

Mr. Exley in reference to my inquiry, who shall make it an axiom that bodies can only act where they are?—makes answer—"common sense." Nay, not *common* sense—cultivated sense, or philosophy, if you please, but not common sense, which is continually presenting to us the appearances, at least, of bodies exercising powers where they are not. It is not impossible that it is a gravific fluid and a magnetic fluid, which respectively produce the phenomena of the tides and local attraction: but we must acknowledge that *it looks* very much like a case of bodies acting where they are not, those bodies being respectively the sun and moon and the magnet; and common sense being satisfied with looking over the surface of things, accepts this explanation of the case. Is it not, however, the dictate of *good* sense and *sound* philosophy that bodies not merely can, but that they necessarily must act where they are not? The place where a body acts is the place where the action is felt. If of two contiguous atoms, one acts upon the other, it must act in the place where the other is, for there the action takes place. To suppose that an atom can only act where it is, is to suppose that the acting atom and the atom acted on occupy the same place. It may be objected that the surface of contact is the place of action. But this is a mathematical surface, and if the atoms are spheres, it is a mathematical point, and these have no place. The action is on one side or the other of the imaginary point or surface, and is of course on the side along with the effect, or rather is itself the effect. It may be objected again, that the axiom in question requires only that the atoms shall be in contact, and that, strictly speaking, it does not mean that bodies can act only exactly where they are. It must mean this, or nothing that is at all essential. Whether two atoms are in contact or not, it has been shown, if they have any magnitude, that action must take place *at a distance*, and simply because, however near, they cannot occupy the same place. This question of distance is the real and influential point in dispute; and if there be *any*, it matters nothing whether it be great or little. Besides are all bodies?—are *any* bodies in contact? These questions would open too wide a field for discussion to be any more than alluded to. Enough has been said, I hope, to show that neither common sense nor philosophical sense will answer for the axiom in question; and that it is only worthy to rank as an intuitive truth "in the region of pure intellect," along with many others which the Schoolmen have left us.

In regard to the subsidiary hypotheses, with which I had stated that Mr. Exley found it necessary to prop up his system, he strenuously contends that he has not introduced any, and founds this denial on the consideration that "he has assumed nothing except what the theory *à priori* indicates." This may be, but the subsidiary hypothesis *is* an hypothesis, although the grand hypothesis should indicate the minor one. The question is, whether some subordinate points are not assumed. Mr. Exley himself admits they are, but then he says he was led to them by his theory. What is this but saying, in other words, that the wants of his theory indicated what was necessary to make it hold together, and which he assumed accordingly. If these subordinate points were unavoidable deductions from his principles, he would not speak of them as being *indicated* by his theory, nor of his having *assumed* them. Mr. Exley does not venture to affirm that they are necessary conclusions from his theory: wanting that character, therefore, I am fully justified in the statement that I made, and which though he impugns he has unwittingly confirmed its accuracy, namely, "that various subsidiary hypotheses are introduced, for

which no reason can be adduced but their convenience, and no proof but their fitness to make facts and theory accord." In illustration of it, I instanced his explanation of the difficulty of accounting, why of all the metals, iron, nickel, and cobalt, are capable, in any particular degree, of becoming magnetical, and quoted the passage, which he says he cannot find in his work. He will find it at page 366. It runs thus:—"In some conductors the fluid may be transmitted merely over the surface, in others through the interior substance; but in such as admit of magnetism, in a sensible degree, it must be capable of entering the surface to a very small distance, and by pressing or crowding the atoms of the body in its course together be incapable of making its way in a straight course; and this condition appears to belong to few bodies." Now, what is all this but pure supposition? The ethereal matter it is assumed must be capable of doing *this*, and incapable of doing *that*, and why?—because the fact requires it, and because the prior subsidiary hypothesis of a spiral channelling of magnetic bodies will not hold good without it.

In the parallel passage quoted from his work by himself in page 117 of your Magazine he observes:—"Now the magnitude of the spherules and forces of the atoms or particles which compose some conducting bodies *may be such*, that they shall be susceptible of receiving and retaining the impressions of the above-mentioned current, &c.; and particularly *this may be the case* with iron and ferruginous bodies." It is quite enough to say that, for aught we can tell, the circumstances may *not* be such, and the case may *not* be as is here confessedly supposed; and what can Mr. Exley advance in support of the affirmative, save only and except, that the wants of his theory indicate the convenience of so representing the matter? It would be vain to refer us to the *fact*, for that may be cited in favour of any other supposition. Even in the case of the true hypothesis it would be reasoning in a circle, for by going back again to the same fact which suggested it, we should obtain no additional evidence. Mr. Exley in effect says—so and so is possible, and therefore *it is*—at least my theory requires that such it should *be; yet in reference* to this very case he says, "no hypothesis is introduced here!" I have been the more inclined to adduce this case in illustration of my observations, from the circumstance that it is at this point philosophers just at the present time are stopped in their electro-magnetic researches. Has Mr. Exley, by the aid of his theory, elucidated the subject in the slightest degree? He has stated how he imagines the fact "may be;" but Ampère's or any other person's "may be," would have the same ground to rest upon. Then there is the subsidiary hypothesis of the mode in which he supposes bodies to be rendered magnetic, namely, by a penetration and a spiral channelling of their substances by an ethereal fluid, and by a constant current in those channels of such ethereal fluid. Now, admitting the existence of the gyrating ethereal currents in the atmosphere, can Mr. Exley prove that the local currents necessarily follow as an effect from such a cause? Does the conclusion inevitably flow from the premises? Unless he can show that such *must* be, and not that such *may* be the case, surely we are entitled to say that this his ingenious supposition, is but a convenient subsidiary hypothesis, in order to eke out or complete the more general one. It is, however, more than problematical, whether this conjecture be as just as it is confessedly ingenious, for I have drawn Mr. Exley's attention to an experiment, which is as I conceive, utterly inconsistent with it; I allude to the fact of a plate of hardened steel being rendered magnetic in very fine lines, by the angular corner of a magnet being drawn over it in any direction. Now if the communication of magnetism takes place, as Mr. Exley contends, by a continuation to the body magnetised of the spiral current which flows around the body of the magnet, such communicated influence ought to be commensurate with the spiral from which it was propagated. But this is not the case, for the magnetic lines are extremely fine, and correspond with the point in contact, and not with the diameter of the spiral around the magnetic bar. This and other experiments were submitted to Mr. Exley for explanation, which he has obligingly afforded. The powers of his theory, he observes, "explain them off hand." Unfortunately, however, it is this very off-hand,

indistinct manner of giving explanations, which affords so much less satisfaction to the reader than it does to the author. Surely the specimens which he has given are cases in point. For instance, in regard to the experiment of magnetic communication just stated, he merely observes, that "in hardened steel the magnetism ought to take place only in the direction over which the pointed magnet is drawn:" by which it also appears, that he mistakes the particular in which the difficulty really lies, it not being in the direction but in the narrow limits of the magnetic influence.

In resuming the metaphysical part of the discussion, I beg to introduce it under a new head:—

Observations on the Metaphysical Doctrines which arise out of Mr. Exley's new Theory of Physics.

Having gone through those observations which Mr. Exley's theory of *physics* has suggested, permit me, sir, to add a few thoughts on the *metaphysics* which grow out of it, more particularly as such an inquiry will give a new aspect to those more recondite speculations, inasmuch as it will show the possibility of connecting the ultimate researches in natural philosophy, with the first steps in mental philosophy, and the practicability of inducting from the phenomena of matter to the phenomena of mind. In these more refined investigations, we have been accustomed to depend upon and advance from the facts and observations peculiar to this department of knowledge; but if it can be shown that we are able to infer some important elementary truths in metaphysics, from the primary laws and forces of matter, we shall have enlarged the dominion and extended the triumphs of the art of induction. In this point of view, it is not necessary to admit that those laws and forces are as yet fully established; but assuming them to be correctly enounced, I proceed to reveal the consequences to which they lead in the region beyond the boundaries of physics; and by making use of a probable truth, the certainty of which may in after times be established even by experimental research, to show the possibility of scaling the barrier of separation which has hitherto been considered impassable, and of laying down lines of communication between those kingdoms of nature which have been thought to be utterly alien, and for ever irreconcilable. It is probable that the sagacious and prophetic observation of Sir Isaac Newton may yet be verified, that "if natural philosophy should be continued to be improved in its various branches, the bounds of moral philosophy would be enlarged also."

I trust to these observations as being sufficient to justify me for introducing a theme which is not very obviously connected with the physical sciences, to which your valuable periodical is more immediately devoted.

It will be recollected that in a former article on this subject, I comprised under four doctrines the opinions which have been held concerning the essential nature of matter, each of which I shortly discussed. They were these:—1. That material phenomena may be referred to an essence or substance which exists without any power that is essentially its own, that is, such substance is supposed not to be really endowed with power by the Divine Being, but simply, that it is by him supplied therewith continually, as the immediate emanation of his own energy; in short, that material phenomena may be referred to a created substance which exists conjointly with divine power. 2. That they may be referred to a created power which exists without any substance necessary to uphold it. 3. That they may be referred to a created substance which exists conjointly and co-essentially with a created power. 4. That they may be referred immediately and solely to the divine power. The two latter doctrines were considered by me to be either of them more tenable and rational than the two former. It is possible to imagine other doctrines, and some strange ones have in fact been promulgated, such as, 5. That the material phenomena may be referred to uncreated substance, existing co-essentially with uncreated power; and, 6. That they may be referred to the divine substance and power. These doctrines, the last of which is the Spinozaism of the west, or the Pantheism of the east, I adverted to only in reference to arguments *reductio ad absurdum*. From the perusal of Mr. Exley's work, I was led to consider that he held the second of

these doctrines, namely, the existence of power without substance, that is, without its being necessary that there should exist also a *substratum*, in order to uphold it, and I was thence induced to offer some considerations in refutation of it. Mr. Exley, however, now asserts, that he contends for "a distinct, really created, material substance," and that he upholds no doctrine of power without substance—to which declaration I, of course, defer; but I cannot so easily submit to the correctness of the assertion which immediately follows, that such doctrine "cannot be inferred from his work or theory:" I formed my opinion from the following passages in his work, and from other similar statements, and I shall think it very strange if any one after reading them should come to any other conclusion.

"Matter is perceptible to man by means of its powers acting on the senses: powers which themselves are in continual operation, and appear to constitute the very essence of matter." "These powers are denominated attraction and repulsion." "Each atom of matter consists of an indefinitely extensive sphere of attraction, resting on a very small concentric sphere of repulsion, the force being every where from the centre, inversely as the square of the distance; repulsive near the centre, and then attractive." "It may be asked, are we absolutely to exclude atoms? I confess I can find no use for them." "It is nothing but a mere hypothesis and a vulgar notion, to judge that there is a minute solid impenetrable mass necessary to constitute an atom of matter on which forces act." "There appears, in fact, to be no use whatever for these infinitely small solids, and it is on this ground that I discard this ideal substratum." "We know nothing of such little solids—we have never seen them, nor felt them, nor perceived them by any of the senses; if they do exist at all, we have not been affected by them, but only by the forces of repulsion and attraction, directed in one case from them, and in the other towards them." "It has been a question of debate much agitated among philosophers, to ascertain what it is which constitutes the nature of bodies, or rather of the *matter* of which they are formed. Some make it to consist in extension, because this attribute first presents itself to the mind; but the same rule might lead us to draw other conclusions, since different views of the subject would suggest some other attribute first to our notice. Besides, all the properties of matter ought to be derived from its nature: now can this apply to extension? How can we derive from it solidity, mobility, attraction, &c.? There may be considered simple extension without any of these. Similar difficulties press upon those, who place the essence of matter in *solid extension*; for how can we hence derive mobility, resistance to impressed action, attraction, or repulsion? These surely cannot flow necessarily from *solid extension*. Will the same objections reach our theory, which places the essence of matter in attraction and repulsion? Do not the other properties of bodies flow from this? Cannot we derive from it extension, figure, solidity, inertia, vis inertiæ, mobility, and gravity, and even divisibility, as far as it is known to extend in fact?" "There is nothing incongruous in the idea that a being infinite in power and wisdom, could direct a power every way *from a central point* to any distance he pleased; and towards the same *point* he could exercise a power contrary in direction, and resting on the former; and this would constitute an atom having all the properties which we observe in the elements of matter." "We know nothing of *matter* but by the forces which it exerts, and which doubtless constitute its nature. Matter is force applied and exerted in a peculiar way; and reciprocally, force operating in a certain mode, constitutes matter."

It will be seen from these extracts, that Mr. Exley overturns and reverses all the commonly received notions concerning matter. Instead of recognising the existence of solid extended particles, and assigning to them as properties the powers of attraction and repulsion, he converts the properties into an essence, deduces thence as necessary *consequences*, and not as *qualities*, the phenomena of solidity and extension, and dispenses with the particles altogether. Whilst he deprives us of those particles as the support or substratum of those powers, he in none of these passages, nor any where else, makes any allusion

whatever to any thing as a substitute for them, but leaves us to conclude, that he is of opinion the said powers can stand and subsist in and of themselves. Hence I naturally drew that inference. I might strengthen the propriety of having done so by adverting to the manner in which he uses the word "essence" in similar instances to the following one. "The forces" or powers in question, "are considered as constituting the essence of matter," by which, in metaphysical language, we ought to understand, that nothing further as a conjunct therewith is necessary to afford support or subsistence; but I prefer to rest the propriety of the inference that he really held the doctrine of "power without substance," rather on what he has said generally, as already quoted, and on what he has omitted to say, than on this peculiarity of expression, which may probably have arisen from a misapprehension of the full import and force of the term made use of. It will, I hope, be acknowledged, that I was fully justified in ascribing such doctrine, in the way of inference, to Mr. Exley, notwithstanding that he now disclaims it; for not having guarded himself on that point, he was sure to be misunderstood. He has now, however, fully explained himself, by stating that "matter is a substance, of course a material substance, really created, and truly and positively existing;" and that he is of opinion the primary powers or forces, which, as will be seen from one of the above extracts, are with him convertible terms with the word matter, "is not a property, but a substance. Yet," he observes, "I rest nothing at all on this: if it is not a substance, then I hold it is the property of some unknown substance co-extended with itself."

The opinions which Mr. Exley has advanced in the foregoing extracts, taking them as they are now explained by him, are not a little remarkable as physical doctrines; but the metaphysical points which they involve, the conclusions which can be legitimately drawn from them, and the bearing which they have on some long and strenuously contested speculative questions, are yet more extraordinary. Possibly, Mr Exley is not aware of these results; or, possibly, he chooses not to be more explicit on this subject than he was in his treatise, on those particulars wherein I had the misfortune to misunderstand him. Let us, however, enter a little on these somewhat recondite speculations, under the full conviction that truth, in any department of knowledge, however obscure, cannot be uninfluential; and, however opposed to prevailing opinions, that its influence cannot be baneful. If, on the other hand, error should be disseminated, the right of free discussion will have been conceded, without which even truth itself, with all its native buoyancy, will not emerge from a mental chaos of stagnant thoughts and motionless ideas.

Let me first observe, that I cannot understand what is meant by stating that power or force may be a substance; that it may be the property of a substance, or of which it may be the action, is clear enough; but I cannot identify or confound them, to my apprehension they are essentially distinct. It was from a similar confusion of ideas that Hume's reverie sprang, of ourselves being merely bundles of fleeting perceptions. Power stands by itself, or does not. If it does not, it is the property of some substance, which is not to be disputed; if it stands by itself, there *is* no substance, or power exists without substance. Not so, says Mr. Exley, for power is itself a substance; then *substance* stands by itself, and the difficulty is only changed (and in truth in terms only), and substance exists without power. But it will be said, that power is involved in the very idea of substance, as in this case understood. Very well; then we just revert to the second alternative, that power *does not* stand by itself; and we gain also the additional truth, that the same may be said of substance. However, let this pass, seeing that Mr. Exley admits the possibility of the existence "of some unknown substance" distinct from, and of which power may be the property.

Let us now inquire a little concerning this substance; for however "unknown," Mr. Exley assumes to know that it is co-extended with its property—the property in question being the forces of attraction and repulsion. This knowledge is derived, I suppose, for I know of no other possible source, from the maxim that bodies cannot act where they are not; but whence the maxim

these doctrines, namely, the existence of power without substance, that is, without its being necessary that there should exist also a *substratum*, in order to uphold it, and I was thence induced to offer some considerations in refutation of it. Mr. Exley, however, now asserts, that he contends for "a distinct, really created, material substance," and that he upholds no doctrine of power without substance—to which declaration I, of course, defer; but I cannot so easily submit to the correctness of the assertion which immediately follows, that such doctrine "cannot be inferred from his work or theory:" I formed my opinion from the following passages in his work, and from other similar statements, and I shall think it very strange if any one after reading them should come to any other conclusion.

"Matter is perceptible to man by means of its powers acting on the senses: powers which themselves are in continual operation, and appear to constitute the very essence of matter." "These powers are denominated attraction and repulsion." "Each atom of matter consists of an indefinitely extensive sphere of attraction, resting on a very small concentric sphere of repulsion, the forc being every where from the centre, i versely as the square of the distanc repulsive near the centre, and then tractive." "It may be asked, are absolutely to exclude atoms? I fess I can find no use for them." is nothing but a mere hypothes a vulgar notion, to judge that th minute solid impenetrable mas sary to constitute an atom on which forces act." "Ther in fact, to be no use whatev infinitely small solids, and ground that I discard thi stratum." "We know no little solids—we have nev nor felt them, nor perc any of the senses; if t all, we have not been but only by the forces attraction, directed i them, and in the oth

because this attribu… self to the mind; might lead us to dr… since different vi… would suggest so… to our notice. … ties of matter o… its nature: no… tension? Ho… in- solidity, mobi… ing may be co… our- without any… this by the ties press… in which sence of… of course a how can… How material?— sistance… nor yet solid; for or repu… are things which necess… s theory, from the the… traction and repul- whi… ties which are per- attr… in themselves in- oth… as being, like all th… such as sound and to… merely of certain e… h, as the case … or as yet un- … substance, therefore, … the phenomena … matter, according to … the word; for … essential charac- … which we lose … heretofore have … ferences in the … t in uncer- … differences do … accustomed to … without solidity … Mr. Exley … ter, whereby … against its … derived from … We have no … to contend … cable differ- … are allowed … such may pos- … the hitherto … concerning … have been … is impos- … stance which, … repulsion, … of solidity … self wholly … possess in … thinking … are disqua- … nature of

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...sistent advocates for its existence
contend, arises from a perception
...matter, in contradistinction from a
...ception produced *by* matter. Hence
arisen the distinction of primary
secondary qualities. By the first,
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...*ctively* or in itself; by the second, we
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...being the cause thereof, but which is
...no means, even in resemblance, to
identified therewith. Thus the sen-
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...nded with the body which produces
or to be considered inherent in it,
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...lities of extension and solidity; these
...e been considered to have a real ex-
...nce *as such*, in external things, to
the proper exemplars of the impres-
...s they produce, and the undoubted
...*cts of direct perception*. The se-

condary qualities allude to external causes which have the power of producing certain perceptions, but are themselves wholly dissimilar to these their effects. A ray of light or caloric, be it emanatory or vibratory, is totally unlike, and is not to be confounded with the sensation of light or heat. But primary qualities allude to causes which it is supposed are themselves perceived in the impressions which they produce; and though not substantially identical with them, they bear a perfect resemblance to them, and are, in truth, identical in respect to all efficient properties and purposes. Thus extension and solidity as sensations, are precisely the extension and solidity of the external material object; that is, cause and effect are supposed to be exactly alike. Wherefore it is, that a knowledge of the nature of matter may be said to be obtained by a perception *of* matter; for though the object present to the mind and the external object are separate things, they are supposed to be in this particular, the one the same as the other; and, therefore, perceiving the one is the same as perceiving the other. So much indeed does this appear to be actually the case, that the judgment is led astray by the illusion; and the general persuasion is, that we have a direct apprehension of material objects, although, as is well known, the brain and the nerves constitute the intermedia of communication between them and the sentient principle.

Scotch metaphysicians saw the difficulty in which the old philosophy is involved, in ascribing a knowledge of the nature of matter to a perception of matter directly as a sensation; and therefore invented the contrivance of perceiving it indirectly, as a conception necessarily superinduced by the sensation. By this subtle distinction, they are enabled to deny the resemblance between primary qualities and the sensations (or the feelings as they prefer to call them) produced by them, which they say are very obscure, and unlike the notions or conceptions which result from and are always presented with them; and it is these last, they say, to which the terms extension and solidity apply, considered as mental impressions, and which impressions bear a resemblance to those attributes considered as external

itself is derived, is yet to be made clear. All this sort of knowledge, springing from intuition and "pure intellect," scorns to be beholden to experience, and pronounces its dicta *à priori*, even in respect to things unseen. Mr. Exley's adherence to this old maxim of the schools is unaccountable, for it involves his hypothesis in insuperable difficulties. If the unknown substance which upholds his power of attraction must be co-extended with it, because that which acts must be situated *where* it acts, I would ask, where then is its limit? The sphere of the attractive property being, as taught by himself, indefinite, the co-extended substance must also be illimitable! I would further inquire of him concerning the *ubi* or *whereness* of the atomic substance, which supports an atomic force of attraction? Will he say that it resides in the mathematical point which is the centre of the attractive force?—or, that being co-extensive with its active influence, it is with it diffused throughout all space?—that it has no place, because occupying all place?—that there are innumerable infinitely-extended atoms?—that no place can be assigned, which is not occupied by all the atoms which exist?—that matter has centres every where, and circumferences no where? Yet how can he avoid answering these questions in the affirmative, whilst he maintains the opinion that substance is co-extensive with action? He is the only philosopher within my reading, who, being an attractionist, did not at once give up the antiquated *à priori* axiom in question. It may be retained by those who use the word attraction merely as the expression of the simple fact, and who conceive the possibility of tracing the phenomena to physical causes beyond it; but it cannot, without the greatest inconsistency, be held by those who contend for the existence of a real attracting force as an ultimate property of matter, and the last link which, in the chain of causes, connects nature with the Deity.

But what is this occult substance of matter, whose particles are devoid of solidity and extension? Mr. Exley further aspires to know of this unknown substance, that "it is of course a material substance." If, by this expression, he would only signify a nominal and *convenient* distinction in reference to substance, as being either material or spiritual, according as it is possessed of the several powers designated by these terms; or, if he would signify a real difference and distinction in reference to those *powers* only, that is to say, if he would convey to us merely the negative idea, that this substance is not percipient nor cogitative, as exemplified in the inanimate world, there would be nothing to object; but we must not suffer ourselves to be led further than this by the positive and qualitative terms in which he speaks of it, as being "of course a material substance." How material?—it is neither extended nor yet solid; for solidity and extension are things which result, according to his theory, from the powers or forces of attraction and repulsion. They are qualities which are perceived, not as being in themselves inherent in matter, but as being, like all the other qualities, such as sound and colour, the effects merely of certain powers in matter, which, as the case may be, are now known or as yet undiscovered. The substance, therefore, which presents us with the phenomena of nature, is not matter, according to the usual acceptation of the word; for its two prominent and essential characteristics are dismissed, by which we lose the distinctions which heretofore have marked the radical differences in the nature of things, and are left in uncertainty whether any such differences do really exist. We have been accustomed to speak of spirit, as being without solidity and unextended; and now Mr. Exley teaches us the same of matter, whereby we lose all the arguments against its being capable of thinking, derived from extension and divisibility. We have no ground left to us, whereon to contend for the existence of any *knowable* difference between them, and are allowed only to conjecture that such may possibly be the case. Thus, the hitherto interminable controversy concerning matter and spirit, turns out to have been a very idle discussion; for it is impossible to deny, that the substance which, by its powers of attraction and repulsion, conveys to us the impressions of solidity and extension, being in itself wholly unknown to us, may not also possess in superaddition the powers of thinking and willing, seeing that we are disqualified from judging of the nature of

matter, and from arguing thereupon, by the representation, that the extension and solidity which we have been accustomed to conceive of, as being of its essence, are really no other than the effects of force or power. We thus lose sight of matter, *as matter,* and are cognizant only of the effects which it is capable of producing, as in the analogous cases of heat and sound. "We know nothing of matter," says Mr. Exley, "but by the forces which it exerts." So, also, we know nothing of spirit, but by the powers which pertain to it. If, then, we are in equal ignorance of each, how can we conceive a difference?—how can we assign a distinction, except in regard to, and as between, those same *powers* which they manifest?

It would be idle, therefore, because utterly without data, to discuss whether certain powers and forces now distinguished as spiritual and material, may or may not unite in a substratum, of which we know nothing whatever; for all validity of argument on this subject, rests on the ground that we *do* know, and have conscious experience of, the very nature and essence of matter, so far at least as this, that it is solid extension. From these premises it is that the argument arises, of the incompatibility of the attributes of spirit with the nature of matter. This knowledge of its nature, all consistent advocates for its existence will contend, arises from a perception *of* matter, in contradistinction from a perception produced *by* matter. Hence has arisen the distinction of primary and secondary qualities. By the first, it is considered that we perceive matter *objectively* or in itself; by the second, we *conceive* of matter in the way of inference, from certain effects or sensations, as being the cause thereof, but which is by no means, even in resemblance, to be identified therewith. Thus the sensation of colour is as little to be confounded with the body which produces it, or to be considered inherent in it, than pain is to be attributed to the sword which inflicted it. Not so, however, with the primary or essential qualities of extension and solidity; these have been considered to have a real existence *as such,* in external things, to be the proper exemplars of the impressions they produce, and the undoubted objects of direct perception. The secondary qualities allude to external causes which have the power of producing certain perceptions, but are themselves wholly dissimilar to these their effects. A ray of light or caloric, be it emanatory or vibratory, is totally unlike, and is not to be confounded with the sensation of light or heat. But primary qualities allude to causes which it is supposed are themselves perceived in the impressions which they produce; and though not substantially identical with them, they bear a perfect resemblance to them, and are, in truth, identical in respect to all efficient properties and purposes. Thus extension and solidity as sensations, are precisely the extension and solidity of the external material object; that is, cause and effect are supposed to be exactly alike. Wherefore it is, that a knowledge of the nature of matter may be said to be obtained by a perception *of* matter; for though the object present to the mind and the external object are separate things, they are supposed to be in this particular, the one the same as the other; and, therefore, perceiving the one is the same as perceiving the other. So much indeed does this appear to be actually the case, that the judgment is led astray by the illusion; and the general persuasion is, that we have a direct apprehension of material objects, although, as is well known, the brain and the nerves constitute the intermedia of communication between them and the sentient principle.

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objects. Still, however, a primary quality is with them identical, in point of similarity, with the object in the mind, be it an immediate sensation or a conception concluded from it by the mind; and it is held by them to be a real and a corresponding entity, inherent in or identified with the external object, and not an inference from the sentient impression to the working of a known or unknown agency, which has its existence in the powers and the operations of nature.

Whatever may be the different shades of opinions, if in these opinions the doctrine of primary and essential qualities is recognised, they must all agree in considering that such qualities do not require, nay, that they do not admit of investigation. Scientific research can have no place, for we already know as much concerning them as it is possible that we can know, for our knowledge is perfect. We have not to seek for their causes or their constitution, for it is in these aspects that we already comprehend them. We have not to resolve their combinations, for they are simple, nor to trace in a series of intricate relations the secret of their constitution, for they are naked ultimate entities, and are in themselves such as they present themselves to us. Nothing further can be asked respecting them, and nothing further can be known, for we know them *as they are*, and our knowledge is clear, distinct, and determinate, and cannot be increased. Not so with the secondary qualities, of which, for the greater part, we have information only, as being an obscure or occult condition of things, whereby they are adapted to raise in us certain sensations, although the sensations themselves, it is true, are equally vivid with those produced by the primary qualities. But then as we cannot infer, as in that case the correspondence or similarity of the external objects, we have every thing to learn concerning them. Here then science finds a place; an entrance is opened to an immense field of research, and birth is given to philosophy. If nature came before us clothed only in numerous primary qualities, we should be all-wise, in all matters concerning the senses, and sensation *would itself* be knowledge in all fulness *and perfection*; but as nature presents us a variety of *indications* merely of its existence, which it may be are only arbitrary signs thereof, and which at least are not resemblances of the arrangements, conditions, and relations, in which only they have their origin, a field of investigation is afforded us for the exercise of our faculties, in discovering the nature of these arrangements, the order, the sequence, and the laws, whence springs the power whereby sentient beings are affected. The mutual adaptation of those things—the one system to create, and the other system to receive impressions—considered simply as a knowledge of facts, is traceable, perhaps, to a very great extent; nay, it is not beyond the bounds of possibility, that it lies wholly within the reach of scientific research; but wherein consists the reason and the efficiency of the adaptation, in contradistinction to what constitutes the circumstances and the sufficiency of the adaptation, is utterly beyond our comprehension, and doubtless ought to be referred to the only criterion, because the sole arbiter of of what is fit and congruous—the supreme will of the Creator.

Mr. Exley's views differ widely from the generally received opinions concerning the qualities of matter, a cursory review of which, as recognising the distinction of primary and secondary qualities, has just been taken. According to him, there exists no particles or bodies which are solid and extended, and as such the objects of perception. Extension and solidity are with him *phenomena*, and it is from the forces of attraction and repulsion he derives these properties, just as he does other properties, involving sound, heat, colour, &c. He has therefore taken them out of the class of the primary, and ranked them with the secondary qualities, or rather he has destroyed these received distinctions, and reduced all qualities to the latter kind. According to this scheme, none of our senses give us any information, in any one particular, of the nature of bodies, but only of their power to affect us. Thus all the qualities of matter, as they are termed—and improperly so, in this view of the subject, for they, without exception, indicate powers only—are comprised in one class. There is no longer any ground to distinguish them, into

those which tell us what matter *is*, and those which show it unto us only in appearances, or, more properly, only in signs and indications, for they are all alike in the condition, of being able to impart unto us presentations only; and we have always been in an error in supposing that any of them can afford us an insight, in any degree, into the nature and essence of matter. Hitherto solidity and extension have been conceived of, as being indicative of matter itself, in its essential qualities, and as referring to the palpable something, which is felt *as being solid* and *as being extended*—as indicative of qualities which are *passive*, absolute, and immutable, admitting neither intention nor remission of degrees, and characteristic, therefore, as Newton says, of universal qualities—qualities which are the exact prototypes of their corresponding mental impressions; but now we are to conceive of solidity and extension as being indicative of matter in its secondary qualities, or in its powers, and as referring to the unknown something as being the remote and occult cause of certain feelings being excited in us, and therefore not in itself to be felt, as being solid and extended. Now, we are to consider them as indicative of qualities which are *active* and variable, being in fact expressive of the effects of encountering a force, which *is* intense or remiss, in conformity with its law; qualities which in their expression or their manner of being known to us, have their seat only in the mind, and in their causes, have existence in principles unperceived by us, except in these their effects, and wholly unlike and different from them.

Notwithstanding that all the qualities of matter are reduced by Mr. Exley to one class, they will still admit of some distinctions, founded not on essential differences between them as heretofore, but on the extent of their generality. Science, or the discovery of causes, is the investigation of properties; that is, it ascertains the conditions, under which matter is enabled to convey to us indications, in various forms, of its own existence; it traces the most general, and if possible the universal and the primary forces, and ascertains the simple impressions which, by themselves, they are fitted, immediately and directly, to produce in our minds; and then it follows on to unravel the more intricate relations, and to ascertain what the dispositions of the primary forces are, by which is constituted the power to excite within us the complex sensations. Hence the properties of matter as the causes of our sentient impressions, may be naturally distinguished, as being either universal, or more or less general, according as those causes consist of the primary forces, or result from their varied and complex arrangements. Hence, also, the universal properties may, in a qualified sense, be termed essential, because if they did not exist, such as they are, matter would be altogether different from what it is—its very constitution would be altered—whilst the less general qualities, which obtain from the mutual action of the primary or universal properties, are necessarily contingent. The term "essential," however, as applied to properties, it must be remembered, will not in Mr. Exley's system indicate, as heretofore, the essence of bodies as being within our cognizance in any degree, but merely the powers which primarily and universally obtain, and which in his hypothesis are the forces of attraction and repulsion. Herein is the power, which he says, "constitutes the very essence of matter," or rather he should have said—what it now appears he really means—that these forces constitute the *essential properties* of matter.

Now, power or force cannot be seen in itself, but only in its results, or as a cause in its effects. We lose, therefore, all the vivid impressions of matter, which hitherto we have received from its supposed solidity and extension, and which we have been accustomed to consider as representing, or even, we may say, as realising its essential nature—we are to rank those qualities along with properties, which merely indicate the capability of matter, under some or all circumstances, as the case may be.

(To be continued.)

NOTES AND NOTICES.

Technological Collection of the Emperor Ferdinand of Austria.—A predilection for the study of rural economy and technology has induced his Majesty to form a collection of raw materials, of manufactures, and of objects of industry of the Austrian States. This he has executed with so much precision and care, that the collection may now be cited as one of the most perfect in the world. It comprehends three principal classes:—1st, a collection of raw materials; 2nd, a collec-

tion of manufactures; 3rd, a collection of models. The first consists of all kinds of unmanufactured products, to the number of 3300; the second, all articles of manufacture or labour, and is very complete; it is interesting not only in a technological point of view, but also for the manner in which the objects are arranged; that is, in the order of the different countries and different manufactures of the empire. The collection of models is divided into seven sections. The number of articles exhibited at the commencement of 1835 was about 40,000.—*Recueil Industriel.*

Steam-Engines in Belgium, and Comparison with the Number employed in France.—There are at this moment in activity in the Province of Liege, 216 steam-engines, exerting altogether 5445 horses' power. Of these 216 engines, 139 are on the right bank of the Meuse, exerting equal to 2176 horse-power; and on the left bank, 79, or 3269 horse-power. Of the whole of these engines, three only are of foreign manufacture. The largest engine is of 300 horse-power; 20 from 50 to 10; 38 from 20 to 50; 139 from 5 to 20; and 1 of 1½. If we join to the motive-power of the steam-engines of Liege that of the engines in other Belgian provinces, a total would be formed of about 20,000 horse-power. It is principally in Hainault, about Charleroi, and in Borinago, that the largest engines are found. According to the reports published by the *Administration des Ponts et Chaussées*, in France, there are 946 engines, representing not more than about 14,051 horse-power. Belgium thus surpasses by about a third the power of all the steam-engines in France. Upon this foundation, therefore, and comparing the respective population of the two countries, we find that Belgian industry is twelve times more developed than French!—*Ibid.*

Granite Polishing Machine.—We have for some time past been watching the progress of a machine for polishing granite, worked by a steam-engine, invented by Mr. Alexander M'Donald, stonecutter, of this town (Aberdeen). Splendid pedestals, urns, tables, columns, and chimney-pieces, have been polished and glossed in a most beautiful manner. It has hitherto been believed, that the blue grey granite from the best quarries in this neighbourhood, Rubislaw and Dancing Cairn, would not receive such a fine polish as the red granite from Peterhead; but the operations of M'Donald's machine has completely belied this.—*Aberdeen Observer.*

Railroads in Russia.—A railroad has just been completed, and will be opened in October, from St. Petersburgh to Zarkejeselo and Pawlowsky; and in the spring two others are to be commenced from the capital to the imperial residences of Peterhoff and Oramenbaum. M. Gerttner is the engineer of these works, and has lately been in England to improve himself in railway matters.

Locomotive for Russia.—A locomotive of a most superior workmanship has just been constructed for the Petersburgh and Pawlowsky Railway, at the manufactory of Messrs. R. Stephenson and Co., of Newcastle. It was tried lately, and exceeded the extraordinary speed of 65½ miles an hour!—*Durham Advertiser.*

A Speedy Method of rendering Hard Water Soft is as follows:—Dissolve six pounds of pearlash, or subcarbonate of soda, in a gallon of soft water; boil the solution; when it boils add two ounces of soap cut into small pieces, and stir the boiling liquid until the whole of the soap is dissolved. When this solution is added to the water to be purified, the soap and sulphate of lime mutually decompose each other, the insoluble compound of the acids of the soap with the lime rises and coagulates at the surface, whence it may be skimmed off. The sulphate of lime may be more slowly decomposed, by adding a small quantity of carbonate of soda or potash. The acid of this will finally convert the lime into carbonate, which will be precipitated when the excess of acid is expelled. The mode which immediately precedes is, however, more certain and rapid, and will fit the water for every use in the arts.—*American Railroad Journal.*

Application of Tannate of Gelatin to taking Casts from Medals, &c.—This substance is obtained by adding a decoction of gall nuts, sumac, oak-bark, or other substance containing tannin, to a solution of glue or isinglass, in water. It is fibrous and nearly insoluble. When exposed to the air in thin layers, it hardens. When moist, it is elastic. The substance which was found to give the best mixture for casts, was finely-pulverised slate. Silica, emery, &c. give pastes which harden, and may be used for razor strops. In making casts of the mixture of tannate of gelatin and pulverised slate, it must be left for a certain time in the mould, in order to preserve the impression. If, however, it is allowed to remain there too long, it adheres strongly. The only difficulty in the application is to ascertain the precise time required for the hardening. This substance may replace bronze in ornaments, papier maché, card work, &c.—*Jour. Connaiss.*

Hint to Railway Directors.—To prevent accidents from the fall of branches of trees on railways, or in windy weather even of trees themselves being blown down across the rails, an absolute power should be given, in the Acts of Parliament, to the Directors of railroads to cut down, or, at least, to cut off the tops of trees (leaving a certain height of trunk) standing within 100 feet of the outer edge of a railroad.—No MECHANIC.

Cotton Trade in Glasgow.—The manufacture of linens, lawns, cambrics, and other articles of similar fabric, was introduced into Glasgow about the year 1725, and continued to be the staple manufacture till they were succeeded by muslins. On the 21st of July, 1834, Mr. Leonard Horner, one of the Parliamentary Factory Commissioners, reported to Parliament, "That in Scotland there are 134 cotton-mills; that, with the exception of some large establishments at Aberdeen, and one at Stanley, near Perth, the cotton manufacture is almost entirely confined to Glasgow and the country immediately adjoining, to a distance of about 25 miles radius; and all these country mills, even including the great work at Stanley, are connected with Glasgow houses, or in the Glasgow trade. In Lanarkshire (in which Glasgow is situated) there are 74 cotton factories; in Renfrewshire, 41; Dumbartonshire, 4; Buteshire, 2; Argyleshire, 1; Perthshire, 1. In the six counties there are 123 cotton-mills, nearly 100 of which belong to Glasgow."

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HANCOCK'S NEW STEAM-CARRIAGE "AUTOMATON."

MR. HANCOCK'S STEAM-CARRIAGE "AUTOMATON," AND STATEMENT OF HIS LATE TRAFFIC BETWEEN THE BANK AND PADDINGTON.

On our front page we present our readers with an engraving of the "Automaton," the last steam-carriage built by Mr. Hancock. One or other of this gentleman's carriages have been travelling, without intermission, since the 11th of May last. That steam-locomotion on common roads is both practicable and safe to the passengers and the public, he has proved; it now remains for him to show (which it will be seen by the following letter, containing a statement of his late performances, he promises shortly to do), that his travelling has been economical, so as to return a fair profit to any capitalist who may embark his money in a speculation of the kind.

Mr. Hancock is now the only engineer with a steam-carriage on any road. Sir Charles Dance, Colonel Maceroni, Dr. Church, Messrs. Ogle, Summers, Squire, Russel, Redmund, Heaton, Maudsley, Frazer, and a host of others—where are they? Echo answers—"Where!" Strange to say, however, we see steam-carriage companies advertised, whose engineers have either never yet built a carriage, or whose carriages when built have never stirred out of the factory yard!

Sir,—Tuesday evening, the 20th inst., completed twenty weeks' continued running on the Stratford, Islington, and Paddington roads, during this year, and I beg to hand you as faithful an account as I can of the performances of my carriages.

Since the last notice in your Magazine, a new carriage, the "Automaton," has been brought upon the road, the only difference between which and those preceding it is, that the engines are of greater power (having cylinders of 12 inches diameter, whilst those of the others are of 9 inches), and the carriage altogether of larger dimensions than the others, it having seats for 22, whilst they are only calculated for 14 passengers. It is an open carriage like the "Infant;" and although only calculated for the accommodation of 22 passengers, it has carried 30 at one time, and would then have surplus *power to draw an omnibus or other carriage containing* 18 more passengers, without any material diminution of speed; its general rate of travelling is from 12 to 15 miles per hour. On one occasion it performed (when put upon the top of its speed, and loaded with 20 full-grown persons) a mile on the Bow-road, at the rate of 21 miles per hour.

The first time the "Automaton" was brought upon the road (the latter end of July) it conveyed a party to Romford, and back, at the rate of 10 to 12 miles per hour, without the least interruption or deviation in its working, although it was the first, or as I may call it, the day of proving; nor has it required any repairs whatever to this time.

After this digression in describing the "Automaton," I will return to the actual work done on the public roads and streets of the metropolis during the last twenty weeks, or five months, in as concise a manner as I can :—

The miles run, about	4200
Passengers carried...................	12,761
Trips—City to Islington, and back..	525
Do. .. Paddington do. ..	143
Do. .. Stratford do. ..	44
Supposing the carriage had always been full, the passengers carried would have been..................	20,420
Average time a carriage has run each day—5 hours, 17½ minutes.	

An exact account of the number of times that the carriages have gone through the City in their journeys has not been kept, but I should suppose that it must be more than 200. For the last five weeks a carriage has been at the Bank twice a day, viz. between the hours of 2 and 3 and 5 and 6 in the afternoon.

It was on one of the morning trips from Stratford to the Bank, through the City, that the steamer became entangled with a waggon at Aldgate; and which, I am happy to say, is the only accident worth recording. The shafts of the waggon were swung by the contact against the projecting front of a shop; the damage done was trifling, and occasioned by the wheels of the steam-carriage having got into the iron gutter, and out of which it is not an easy thing to gain the fair surface of the street with any ordinary carriage in so confined a situation as that part of Aldgate in which the accident happened; and it should be observed, that this occurred in making way for another carriage passing at the time.

I will now give you an account of all other accidents (which have all happened to the damage of the steamers them-

selves) viz. the chain pulley of the "Enterprise" once broke on the axletree; the same occurred once to the "Infant," which were permanently and immediately replaced by castings from the same pattern, with a greater thickness of metal, and which have since stood well.

The severe test afforded by the state of the City Road and onward to Paddington, caused these failures; for the pulleys had stood well on other roads, for many miles.

Another accident was a hind-wheel of the "Erin" coming off in the New Street, near the Bank, on which occasion the carriage sunk only about eight or nine inches, in consequence of the frame-work of the machinery taking the ground; and so little was the coach thrown out of the level, that the inside passengers were surprised when informed that the wheel was off. The concluding accident was by the steerage chain of the "Infant" being too slight, and breaking at Islington, when the carriage turning short round, with one of the fore wheels against the curb, the wheel was broken. This wheel was an old one, of much slighter construction than I now make them.

In the early part of the five months' running, the close-bodied carriages, "Erin" and "Enterprise" were about equally employed—in the latter part, and to the present time, in consequence of the fine weather, the open carriages "Infant" and "Automaton" have been running.

I have occasionally examined the boilers and engines of all the carriages, and found that the engines have in most parts actually improved, whilst the boilers and fire-places have suffered a deterioration, less than could have been expected, from the use they have undergone.

It may be remarked, that both boilers and machinery are suspended on well-acting springs, and which accounts for the state of all the parts being so well preserved. Some of the boilers have been in use for two or three years.

There have been consumed in the before-mentioned traffic, 55 chaldrons of coke, which is equal to 76 miles per chaldron, or about $2\frac{1}{4}d.$ per mile for fuel; but this on long journeys would be much reduced by the application of the moveable fire-place, patented by me about three years ago, as our greatest expenditure of coke in these short journeys is in lowering and again raising the fire.

I cannot conclude without noticing with gratitude the general civility and attention which I have met with, and my pleasure in discovering that the antipathies which existed in the earlier part of my career are gradually subsiding, and that, in fact, never now meet with incivility excepting with a few carters or draymen, who consider the introduction of steam-carriages as an infringement upon the old-established use of horse-flesh.

Years of practice have now put all doubts of the economy, safety, and superiority of steam travelling on common roads at rest, when compared with horse travelling; and I have now in preparation calculations founded upon actual practice, which when published will prove that steam-locomotion on common roads is not unworthy of the attention of the capitalist, though the reverse has been disseminated rather widely of late by parties who do not desire that this branch of improvement should prosper against the interests of themselves.

After twelve years of incessant labour in steam-locomotion,

Your obedient servant,
WALTER HANCOCK.

Stratford, Sept. 22, 1836.

FIRES AND LONDON FIRE-ENGINES.

Sir,—Nothing that has appeared in your pages for a long time has surprised me so much as the article copied from the *Spectator* into your last Saturday's Number.

Such a mass of falsehoods and blunders are not often met with in the limited space occupied by the article in question, the writer of which evidently knows just as much about fires and fire-engines as the fire-engines know about him. At the outset he asserts, in the boldest manner possible, that "our engines do not put out fires, but only keep them from spreading with the aid of party-walls; where these are wanting, the only preventive means is to isolate the flames by pulling down adjoining buildings!"

Having watched these matters much more closely than any other *disinterested* person, I feel myself bound to state that this is wholly false. The real fact is, that out of 471 fires which happened in Lon-

don and its suburbs last year, 440 were not only "prevented from spreading by the aid of party-walls"—*but were actually put out by the engines.*

With respect to what the *Spectator* terms the "absurdly inadequate power of our fire-engines," I may just state, that the engines of the London Fire Establishment deliver a stream of water three quarters of an inch in diameter. In a recent trial, one of these "absurdly inadequate engines" threw a jet of water on to the top of the tower of St. Mary Aldermary's Church, in Bow-lane, which is upwards of 120 feet high. Very few fires can live under the effect of "a dozen such jets playing at once."

The *Spectator* speaks of "Braithwaite's floating-engine on the Thames" throwing a stream of water "about the bigness of one's arm." The writer has here, as you justly observe, as well as in many other parts of his communication, laboured under a great mistake. In the first place, Mr. Braithwaite never had any floating-engine on the river; secondly, neither he nor any other party ever made an engine capable of throwing a stream "about the bigness of one's arm!" But then, says this extraordinary writer, "it is only available in cases of fire near the river-side, and then not at low water—which was the cause of its not rendering such good service at the fire in question"—that is, the late fire at London Bridge; *a river-side fire at the time of high water!* Bravo! The writer could have been no *spectator* there, I guess.

Without stopping to notice the absurd remarks about the waste of water, or the newly-suggested, old-fashioned, and inconvenient mode of supplying water to the engines, which is gravely proposed to supply an amazing "increase of propelling force"—I pass on to the *grand idea* of a stream of water not less than SIX INCHES DIAMETER. This is truly magnificent; but where is a supply of this element to be obtained equal to so splendid a conception? Oh! from the Thames—and the engines are to be worked? By electro-magnetism, of course! Of the efficiency of such a stream there can be no doubt; but as it will take some time preparing, in the interim locomotive-cisterns are to be employed, which shall in due order leap on to the burning *buildings*, and at once settle all doubts about putting out the fire. But should none of these schemes "be practicable"—"the column of water propelled by the engines ought at least to be greatly increased." That is to say, the engines must be doubled in power, the number of firemen proportionably increased, and the water companies compelled to furnish a quantity of water adequate to supply such engines; sooner said than done, I reckon.

The Quixotic style and manner of the *Spectator*, after all, is so provokingly droll, that it is exceedingly difficult to write seriously upon any of the subjects he has treated of, and I cannot help thinking he had only just laid down *Gulliver's Travels*, when he commenced the article before us.

It is an undoubted fact, that all fires have small beginnings, and that, at some period of their career they may be extinguished with very slender means, but in proportion to the time they rage unchecked, and the nature of the materials within their reach, the extinguishing of them becomes every minute more difficult; in fact, fires may, and sometimes do, attain so great a head, as to be wholly unextinguishable. This was most assuredly the case at the late calamitous fire at London Bridge, so far as the larger warehouses were concerned—the fire having gained so great an ascendancy there before the engines were supplied with water, as to defy all earthly power to extinguish them. Nor was the attempt to do so long persisted in, the firemen's power was far more usefully employed in combating the fire in the surrounding buildings in which it had made more partial progress. In the houses of Messrs. Grant and Co., Burford, Pocock, Edgington,* Whiting, and several others, the fire was not only "prevented from spreading with the aid of party-walls," but was actually *put out by the engines.* The engines were called from this very fire to another which broke out in Union-street, and these "absurdly inadequate" machines put that fire out too—as they have done several others since.

As this communication is somewhat lengthy, I shall not proceed any farther at present, but will seize an early opportunity of offering some remarks on the relative usefulness of large and moderate sized fire-engines, respecting which much

* Vide Mr. Edgington's advertisement of thanks in the public print.

difference of opinion and much positive ignorance prevails.

I remain, Sir,
Yours respectfully,
W. BADDELEY.

September 20, 1836.

THEORY OF THE TIDES—REPLY OF URSA MAJOR TO KINCLAVEN.

Sir,—My old acquaintance (according to his own statement) Kinclaven is very amusing, and might be indulged in the ludicrous display which he makes of his misapprehensions or misrepresentations, for it is difficult to say which they really are; were it not that the notice of his absurdities materially interferes with our more serious engagements. In my last, I stated in as plain a manner as language could speak, that I set no value whatever upon any of the demonstrations, so called (Dr. Wilkinson's included) respecting the tides, always saving and excepting Kinclaven's, of course. Having remarked, that the absurdities to which Mr. Clarke's "ocular demonstration" (which is the same in principle as Dr. Wilkinson's) would lead, were, if possible, worse than those that were attempted to be removed, it appeared to me that no misapprehension could arise upon the subject. But I suppose Kinclaven is rather dull of apprehension, notwithstanding the very intense study which he has bestowed upon the multiplication table. From whatever cause his dulness may proceed, it is very plain that he either *cannot* or *will not* receive the animadversions of Ursa Major in the proper and obvious acceptation, but must twist and distort them to suit his own ends and purposes.

Well, let us see what he gains by this perverseness. He has favoured us with a long list of figures which shows very clearly that he has studied the multiplication-table to some purpose, in which he proves by "following out the Doctor's plan, that the gravitating force of the moon will only raise the sea $\frac{1}{77}$th part of an inch." Now, gentle reader, in what way do you suppose Kinclaven obtains this result? By a quibble—Dr. Wilkinson not having the fear of the "great Kinclaven" before his eyes, is rather loose and careless in his enunciation. He says, that 3600 lbs. on the surface of the earth removed to the *moon's surface*, would only weigh 1 lb.; whereas he ought to have said, that 3600 lbs. *removed to a distance from the earth equal to the distance of the moon's surface*, would only weigh 1 lb., or be attracted towards the earth with a force equal to 1 lb., which is clearly his meaning. However, it did not suit Kinclaven to take the obvious meaning—the literal sense was better suited to his purpose. This is "too bad," Kinclaven; the Doctor's demonstration, as he styles it, was sufficiently absurd without this sinister mode of dealing with it. However, Kinclaven has added one more example to support the position of Ursa Major, that is, that there are a variety of demonstrations so called, and that the various "Doctors" and "great mathematicians" who have favoured the world with the aforesaid demonstrations, contradict each other, and, *ergo*, they cannot be all right. Ursa Major presents his compliments to Kinclaven, and begs to assure him that he will ever retain a lively sense of the great service which the cause of truth has on this memorable occasion derived from the pen of the "great Kinclaven."

Having thus acquitted myself as handsomely and politely as can be reasonably expected of a "*great bear*," I think I may be allowed to offer a suggestion to Kinclaven which may be of great service to him in his profound studies. To give it the more weight, I shall derive it from his own observations, he being, in his own estimation, no doubt, a very great authority. Amongst other profound observations which he makes upon Dr. Wilkinson's "demonstration," he says, "HIS DATA ARE FAR FROM BEING CORRECT." Kinclaven, the whole argument turns upon this point; if we had a full assurance in every case of the correctness of the data from which our conclusions are deduced, any difficulty respecting the conclusions themselves might be obviated without any very serious embarrassment. But, unfortunately, we are not in every case well assured of the correctness of the data. I would recommend you, Kinclaven, before you place full confidence in any conclusion which may happen to be honoured with the name of a demonstration, to examine the data rigidly. Place no confidence in the authority, whether it may happen to be Laplace, Lagrange, Dr. Wilkinson, or

any other profound mathematician. If you will be advised to follow this method, you may take the word of Ursa Major, that although your trust in the miraculous potency of algebraical symbols in bringing dark things to light, may be a little shaken, you will be all the better philosopher for that course of study. It is the characteristic of an undisciplined mind, to speak positively and dogmatically; experience teaches us to speak with reservation. By way of introduction to the course of study here recommended, I would offer a quotation from the writings of an eminent mathematician of the present day, who differs from the greater part of those "great men;" however, in one very essential particular, that is, although he has attained to some eminence as a mathematician, he has not on that account discarded the rules of common sense, but shows that mathematical reasoning is the same as all other reasoning, differing only in this respect; —the conclusions are deduced from the premises by following certain fixed principles that may at all times be relied upon, *provided always that we are certain of the correctness of the* DATA *from which those conclusions are deduced.* His observations are these—"There is a mistake into which several have fallen, and have deceived others, and perhaps themselves, by clothing some false reasoning in what they called a mathematical dress, imagining, that by the application of mathematical symbols to their subject, they secured mathematical argument. This could not have happened if they had possessed a knowledge of the bounds within which the empire of mathematics is contained; that empire is sufficiently wide, and might have been better known had the time which has been wasted in aggressions upon the domains of others been spent in exploring the vast tracks which are yet untrodden."

Time and reflection will teach Kinclaven that we are not to place implicit confidence in great names, however high those names may stand in the world of science. He will also recollect, that the system of Des Cartes was defended by some of the most eminent mathematicians of Europe, to the latest hour of their existence, in defiance of all the demonstrations which were presented to their notice by the illustrious founder of the *Newtonian system.* So you see, Kinclaven, great men have been sometimes sadly in the wrong.

However, the controversy between Kinclaven and Ursa Major relates to the demonstrations connected with the tides as deduced from the laws of universal gravitation. Well, Ursa Major will suppress his own observations till he has taken a spell at the Tutor's Assistant; and for the present we will let the "learned Doctors" and "great mathematicians" speak for themselves.

Kinclaven says, "Laplace, and every writer of eminence in physical astronomy, have demonstrated that all the phenomena connected with the tides are strictly in accordance with the principles of universal gravitation.

Professor Whewell says, "Though there can be no doubt (which always means we are not quite certain,) that the tides are to be reckoned among the results of the great law of universal gravitation, they differ from all the other results of that law in this respect, that the facts have not in their details been reduced to an accordance with the theory."

Kinclaven says, "Laplace has demonstrated that gravity darts its influence fifty millions of times faster than light."

Mr. Lubbock says, "If the moon were to be annihilated, we should have two, three, or more tides, notwithstanding, because it was the moon, as she existed fifty or sixty hours before, or five lunar half days, which caused the disturbance of the ocean."

Kinclaven says, "Bernoulli has given a demonstration." Mr. Lubbock says, "No reliance can be placed upon Bernoulli."

Damoseau has given formula deduced from theory. Mr. Lubbock says, "They are totally unintelligible."

It is needless to multiply instances, they are endless; these few relate entirely to the question as it stands at the present time. How any individual can talk of the phenomena relating to the tides having been rigidly demonstrated to be in accordance with certain unerring laws, seeing all these conflicting statements, and many more besides these, Ursa Major is at a loss to conceive. Professor Whewell seems to be inclined to give up the theory altogether until it can be brought to coincide more nearly with the facts. "With regard to observation," he remarks, "the Port of Bristol

culiar advantages, for in conse- of the great magnitude of the re, about fifty feet, almost all liarities of the phenomena are l, and may be studied as if microscope." This is a good would advise you, Kinclaven, to p to Bristol, and get a peep into Whewell's microscope. This ghten your mind much better e subject than poring over the ation table and thumbing the Assistant;—when you return you haps, be able to give us a de- ion of the tides as incontroverti- he 47th proposition of the First Euclid.

Major wishes you a pleasant jour- he sake of "old acquaintance." e, "GREAT KINCLAVEN!"

Yours, &c.

URSA MAJOR.

L FOR NAVIGATING THE RIVER STEAM. BY COL. MACERONI.

The same principle which prompt- request admission in your pages aper on the introduction of sal- the river Rhone, prompts me to e you a plan for the steam navi- f the river Po, in Northern Italy. xtension of the use of steam must he advantage of England, which eat workshop of the world in all gards machinery, iron, steam- &c. Although I have not been nate as to derive a benefit from estion contained in the enclosed thers may. Any how, it is an n of facts and useful truths. If disregarded, it will be no more than in innumerable other occa- hen one would suppose that "a s heard *in the wilderness.*"

have the honour to be, Sir,

Your obedient servant,

F. MACERONI.

, 1836

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bmitting to my friends, or to ic, a proposal of the present na- would be superfluous to dwell *eneral* advantages of steam navi- ince these have been so triumph- stablished by the best of all rators—long and multiplied ex-

ler to show that in any particular instance the establishment of steam navigation would produce beneficial results both to the establishers and to their customers, it will, I presume, be enough to point out certain required conditions of locality. These I take to be:—That there should be convenient means of constructing the vessels and apparatus on the site itself, or of conveying them thither from elsewhere; that there should be sufficient extent and depth of water; sufficient merchandise and passengers to form freight; and abundance of fuel, at certain proportionate prices.

The line of steam navigation which I propose to establish admits of the foregoing conditions in a most eminent degree. I propose to navigate the river Po—as high as Turin towards its source, and beyond its mouth; on the north, to Venice; and south, to Ravenna, Rimini, Pesaro, Fano, Sinigaglia, and Ancona. The Lakes Maggiore and Como, which communicate with the Po by the rivers Ticino and Adda, will, especially the former, make admirable additions to the plan.

The distance from Turin to the mouth of the Po (Bocca Maestra) is, in a straight line, 200 Italian miles, of 60 to the degree, or 240 English. Along the course of the river it is about 300 Italian (360 English) miles.

On the above extent of navigation are situated the cities of Turin, Chivasso, Casale, Valenza, Pavia (University), Piacenza, Cremona, Guastala, Governolo, and Ferrara, besides more than a hundred populous boroughs and villages; and in the immediate vicinity of the river are the cities of Alessandria (the celebrated fortress), Milan, Lodi, Crema, Brescia, Parma, Mantua, and Mirandola, all which, with the exception of Parma and Mirandola, communicate with the Po by navigable canals or rivers.

With regard to the depth of the river Po, I can aver to have crossed it in all seasons, and at various points, from Turin to Ferrara. At all these points I have seen boats of 60 or 80 tons burthen, which from their clumsy construction, with high sterns and poops, must certainly draw much more water than necessary. Those which go down the river with charcoal, wine, corn, oil, &c., are constructed in a very coarse, rough manner, and are never taken back against the stream, but broken up at the end of the

voyage. There are no towing-paths along the Po, except in a few particular places of very limited extent. Indeed, I do not think it would be possible to form a continuous one, as the deep navigable channel is often times amidst islands and sand-banks, at a considerable distance from the actual banks of the river.

The Lago Maggiore extends from Sesto Calende, in Piedmont, in a northerly direction, to Locarno, in the canton of Tessino, in Switzerland, being 40 Italian, or 48 English, miles in length, and on an average about 6 in breadth. It communicates with the Po by the river Ticino, which from Sesto Calende to Pavia is about 60 English miles in length, and very deep throughout. The shores of the lake, and the banks of the Ticino, are thickly lined with populous towns and villages. There are two navigable canals from the Ticino to Milan, distant about 20 miles.

The Lago di Como is about 36 miles to the east of the Lago Maggiore, to which it bears a striking resemblance in figure and dimensions, only extending about 10 miles further north to the borders of southern Tyrol. From the southern extremity of the lake issues the river Adda, which, after a southern course of about 70 miles, passing through Lodi, Pizzighittom, &c., joins the Po between Piacenza and Cremona. I cannot speak from personal observation of the depth of the Adda, but from what I have heard, and from the fact of there being a navigable canal (Canal di Martisana) from the town of Brembate on that river to Milan, distant 16 Italian miles, and Brembate being only one-third of the distance from the lake to the Po—its depth is to be presumed sufficient throughout for navigable purposes. For if the upper part of its source, from the lake to Brembate, which is the most rapid and shallow, be actually navigable, it is not likely to become otherwise after receiving below that town no less than eight considerable tributary streams.

The mouth of the river Po is only 25 (30 English) miles distant from Venice, on the north; and towards the south, within 100 (120 English) miles of coast, are the ports of Comacchio (20), Ravenna (35), Cervia (45), Rimini (60), Pesaro (77), Fano (82), Sinigaglia (93), and Ancona (100), to which ports the steam navigation might be advantageously extended, and meet with plenty of passengers and goods. The supply of colonial produce to the interior, and the coasting trade between Venice, Ancona, and Sinigaglia, during the great fair, and the returns of agricultural produce, would be very great.

An immense quantity of English goods and colonial produce are transported by land from Genoa to Arona, on the southern extremity of the Lago Maggiore, where they are embarked for Locarno, at the northern end, at which place, and at Megadino, great depôts are constantly kept for the supply of Switzerland, Tyrol, Veltalina, and (by contraband) the Bergamasco, and great part of Austrian Lombardy. Now, by the steam establishment all these goods would only have to be sent from Genoa to the river Po, and conveyed at once up the Tessino into the lake. The shores of the lake and its celebrated fairy island (Isola Boromei) are covered with villages and country-seats, which, particularly in the summer, would produce numerous passengers to and fro in every direction. From the elongated configurations of both of the lakes (Maggiore and Como), embosomed in mountains from north to south, it generally happens that the winds blow for a long period either up or down the lake, during which time the vessels of the country can proceed only but in one direction. This circumstance alone, though comparatively trivial, would suffice to give the steam ones a decided advantage.

The country to the north of the Lake Maggiore abounds with iron-works, from which all the north of Italy is supplied both with bar and cast-iron, and some steel. What a great diminution would the substitution of steam-boat instead of land-carriage effect in the price of such articles!

Of the Lake of Como I cannot speak from personal observation, but I have every reason to believe that a steam-vessel, even were it merely confined to the lake, would answer extremely well, with passengers alone.

I am not aware of mineral coal being found in any situation or quantity so as to make it available for the steam navigation I propose. I have seen specimens from the Valtelina, but I believe there are no mines actually worked. Wood, and consequently charcoal, are cheap. The iron-founders of Bellinzona, Morobbio, &c. pay for charcoal 1 franc, 25

cents, the bissaccone of 15 rubbj, or 282lbs. I have seen it quoted at 1 franc, 2 cents.

There are already two steam-boats on the Lake of Geneva, and one on that of Constance, which have made the fortunes of the establishers. These lakes are but huge fish-ponds, without navigable outlets. How much more important would be the results of such an undertaking on the Lakes Maggiore and Como, which are open to the river Po and the Adriatic Sea!

At various places on the river Po, as well as on the two lakes above-mentioned, there are many yards, or docks, for the construction of large flat vessels or boats, where every material and convenience would be found for building the steam-vessels; unless it should be preferred to send them in frames from England to Genoa. I should hope that steam-vessels for such a purpose would be made of iron. The machinery may be imported both into Piedmont (Genoa), or into Austrian-Lombardy, duty free, all kind of machinery being exempt from duty.

There is no manner of doubt but that both the Sardinian and Austro-Italian Governments would readily grant a patent for a certain number of years to any Company that would undertake the business.

F. MACERONI.

London, July 1, 1824.

AERONAUTICS—COMPARATIVE SAFETY OF MONTGOLFIER AND GAS BALLOONS—PROPOSAL FOR AN AERONAUTIC CLUB.

SIR,—Although I agree with your very intelligent correspondent, Colonel Maceroni, as to the impracticability of guiding balloons so as to apply them to any useful end, yet I think his assertion, that wings or oars have no effect whatever upon their motion, is contrary to past experience. I will cite two instances from Brewster's *Edinburgh Encyclopedia*, article *Aeronautics*:—1st. "In June, 1784, Messrs. Roberts ascended in a balloon, to the car of which were attached five wings or oars. In the course of their voyage finding themselves becalmed, they had recourse to their oars, by the exertion of which their balloon in 35 minutes described an elliptical segment whose shortest diameter was 6,000 feet.—2d. In June, 1786, "M. Testu ascended from Paris with a balloon 28 feet in diameter, on the motion of which he was able to produce a very sensible effect by the manœuvring of wings. It was filled only ⅘ths with gas; but at 2900 feet high became quite full. Dreading the bursting of the balloon (he appears not to have used a valve) should he ascend higher, he applied himself vigorously to manœuvring the wings, and after much difficulty and severe labour, descended in the plains of Montmorency to take in ballast."

The balloon in the former instance cited was also of the "fish-like" form, which Colonel Maceroni thinks would not rise in the air in a proper position. It was an oblong spheroid, 46 by 27, the longer axis being parallel to the horizon; the car 17 feet long. Yet it ascended, as was expected, and Messrs. Roberts partially navigated it by wings, as above-mentioned.

The comparative danger of the fire and the gas balloon is another point on which I would question the correctness of the Colonel's opinion. On the one hand, no fatal accident has ever been consequent upon the bursting of an air-balloon, or from one ever having been damaged by lightning; while, on the other hand, M. Pilatre de Rozier (the very first aeronaut) and M. Romaine lost their lives through the burning of a fire-balloon. Besides the fact, that silk is a non-conductor of electricity, as is also the gas itself when dry—numerous instances have occurred of balloons passing through lightning-clouds and storms in safety. In the case quoted before of M. Testu's ascent, "he passed through clouds which emitted vivid flashes of lightning. An iron point fixed to his car emitted a stream of light from the positive electricity of the atmosphere; and when negative it exhibited a luminous spot. His flag sparkled with fire during the darkness of the night, while the thunder rolled and the lightning flashed around him. On his descent, his clothes and balloon were impregnated with a strong sulphurous smell, and his flag had been rent by the lightning." Here, then, is an instance of a balloon enveloped in electricity, and yet, evidently from its non-conducting nature, scathless. A correspondent of one of the daily papers lately suggested the attaching of a dozen or twenty balloons to a

ship-like car, which was to have masts, sails, and rigging, and sailors to manœuvre it; and, above all, metal lightning-conductors from the top of the masts to the bottom of the car! Pray where did he mean the electrical fluid to go after it had travelled through the rods?

As to the objection, that gas-balloons are liable to burst, no accident has ever happened in that way; although there are several instances on record of balloons being rent by the extension of the gas, yet they always came safely to the ground, the flaws being only large enough to allow of a gradual escape of the gas. After all, in my opinion, the two kinds of balloons are about upon a par as regards safety, and I would as soon trust myself with the one as the other.

As a Montgolfier is, however, evidently the cheapest, I would make a suggestion as to its greater security: might not that part of the balloon in the vicinity of the fire be made of asbestos? And, further, would not woollen or worsted stuff be less combustible than cotton? A spark or flame applied to the former would only singe the portion in immediate contact with it, while the latter would blaze up.

For security, in respect to both kinds of balloons, I would suggest that the car should be so balanced that, in the event of the sphere bursting or being burnt, it would maintain an upright position in the air, and fall with its bottom downwards. The fall would also be greatly broken by a parachute of very moderate dimensions, and on touching the earth, still further by helical springs in proper positions on the bottom of the car. An aeronautic life-preserver might be made in the shape of a loose dress attached firmly round the shoulders, stiffened with ribs of whalebone, hinged at that part; each of which ribs should have a stay from near its extremity to the waist, so that in the event of an aeronaut falling out of the car, or the destruction of the balloon, the parachute dress would expand and bear the wearer gently to the earth. A parachute of about 12 feet diameter was found by Mr. Blanchard to be sufficient to bear a man safely to the ground from any height; and M. le Normand threw himself from a house, and descended in safety with a parachute of only 30 inches diameter.

These precautions should not be considered as unnecessary, or out of place, when aerostation has become so popular that ten or a dozen persons ascend with one balloon.

I will now, sir, make a proposal, which I leave to your discretion whether to make public or not in your Magazine. Taking advantage of Colonel Maceroni's offer of assistance, I would propose an "Aeronautic Club," consisting of about a dozen or more gentlemen, who, by subscribing a few pounds each, might have a Montgolfier balloon constructed, in which the subscribers should ascend by turns, to be decided by lot—some for scientific observation, and others for mere curiosity.

I have made a rough calculation of the probable expense of a balloon for such a club, and I here submit it to your readers. The Colonel says, a Montgolfier, 40 feet diameter, would take up four persons. Suppose, then, we estimate for one of 50 feet diameter to carry five persons; the rule to find the quantity of cloth required, as given in the *Edinburgh Encyclopedia*, is to multiply the square of the diameter by 3·1416; therefore, $50 \times 50 = 2500 \times 3{\cdot}1416 = 7854$ feet = 2618 yards, which at 6*d.* per square yard (a good price for cotton, or bombazet as before suggested), would be 65*l.* 9*s.*; and for making say 10*l.* Of the other expenses, the Colonel is no doubt better able than I am to give an estimate; with which he will perhaps oblige your readers, as also with an opinion of the plan. With your permission, sir, your publisher will take charge of any letter from parties desirous of joining the club, addressed to,

Sir, your obedient servant,

UMBRA MONTGOLFIERI.

THE DAVY-LAMP.

Sir,—It is evident from the commencement and termination of your correspondent "Black Diamond's" letter, which appeared in your publication of the 10th inst., that he labours under the impression that the Davy-lamp has not yet been proved insecure, by "the *inflammable gas actually* evolved in coal-mines." The contrary is the fact; the error general. A reference to the evidence given before the late Committee on Accidents in Mines, will show that the trial of that lamp has not been confined to *factitious gases.* Mr. Buddle's evidence, p. 154, records its first trial and failure. He

says, "I held the lamp in the direction of the jet of fire-damp, and not having seen it explode before, I was not very apprehensive of its firing. It did not fire at first; but as I approached the end of the pipe, the gauze became heated red-hot, and passed the explosion. The flame was as long or longer than the breadth of the engine-room. I remember it burnt the nap off my great coat and spoiled it. The experiment was repeated over and over again." It may be observed, that this experiment was tried as long since as the year 1816. The inflammable gas issued from a blower in the Morton West Pit, one of the Earl of Durham's collieries. Sir H. Davy was present, and it appears, from Mr. Buddle's account, explained on the spot the danger of exposing the lamp to a current of explosive mixture (fire-damp), as he said it would risk the passage of the flame through the gauze.

Another recorded and recent instance of its failure with fire-damp, attended with a fatal result, is described by Mr. George Mitcheson, an extensive mine-agent, and one of the witnesses examined before the Committee, who states, p. 190, "that he saw two men go down the Green Dock Pit, Staffordshire, with a Davy-lamp; and that after they had descended, a pail of water was thrown down the shaft, with an idea of increasing the ventilation. That as soon as the water was thrown, the pit fired, and one of the men was killed; the survivor, who was sadly burnt, said that as soon as the wind came, the gas exploded—no other light was in the mine at the time." The next witness, Mr. William Forrester, agent to the Earl of Granville, states, p. 199, "I have seen a lamp (a Davy) fire the carburetted hydrogen gas in a thirling." I shall conclude this part of the subject by a reference to a trial of the Davy-lamp, also with the *actual inflammable air* evolved from coal, described in a certificate presented by Mr. Roberts to the Committee on his examination, and published by them, p. 260. It states—"On the inflammable air being brought to act on the Davy-lamp, the flame passed through the wire-gauze and ignited the gas outside." This experiment took place in Parks's colliery, near Dudley, March, 1834. The inflammable was taken from a sumpt in the colliery, and its explosion witnessed by M-. Parks and seventeen other persons, his workmen, who signed the certificate referred to.

It may be urged, though I do not expect it will by so intelligent a person as your correspondent, "Black Diamond," that the Davy-lamp ought to be considered safe because it has never been proved unsafe in a quiescent atmosphere. If this argument be used, I shall not be so wasteful of your valuable space, even if you would permit it, as to attempt its refutation; for surely the claim of "*safety*" ought not to be allowed to an instrument, the protection of which can be destroyed by that which is ever to be expected, is of frequent occurrence, and against which no human care can guard—viz. the agitation of the atmosphere of a coal-mine. If this, sir, were a subject on which individual feeling could with propriety be expressed, I should thank your correspondent, B. D., and yourself, at some length, for the opportunity this letter gives me of making the fact known, that the Davy-lamp has been found insecure—not only with factitious gases, but with the inflammable air of coal-mines.

I remain, Sir,
Your obedient and obliged servant,
GEORGE UPTON.

London, Sept. 21, 1836.

BEST WIDTH OF RAILROAD TRACKS.

(From the *American Railroad Journal*.)

Sir,—In a late Number of the *Railroad Journal*, I observe a communication from the President of the New Orleans and Nashville Railroad Company, in which it is stated that engineer H. J. Ranney, Esq., of that road, proposes an increase in the width of the railway track, viz. $5\frac{1}{2}$ feet instead of 4 feet $8\frac{1}{2}$ inches, the width generally adopted, and requesting the opinion of professional men on the propriety of the change. It has long appeared to me that our engineers were labouring under a mistake, in restricting the width of track upon our railroads to $4\frac{3}{4}$ feet. My reasons for this belief, I will briefly state as follows:—

1st. By increasing the width of track, the maximum speed for safe travelling may be increased. This is owing to the fact, that with wheels of a given size, the breadth of base compared with the height or elevation of the centre of gravity of the load is increased—the carriage, when under an equal motion, possesses therefore greater stability, and will bear a greater speed without increasing the danger of "flying the track."

2nd. The diameter of the wheels may be

enlarged, and the carriage possess equal stability, and under the same rate of speed the engine would make fewer strokes. The advantage of this is evident. In high motions, it would result in a saving of power. The movement of the piston being slower, the expansive force of the steam would have greater effect. There would be less friction, less wear and tear of the parts of the engine, more steadiness of motion, and less frequent occasions for packing the piston-plate, and repairing and tightening the joints.

3rd. The narrowness of the tracks upon our railroads, has been the cause of great inconvenience in the construction of engines, the space being insufficient for the requisite size and proper arrangement of its parts. This is a consideration of great importance in a practical point of view, and is entitled to great weight.

4th. By increasing the width of the track, the motion of the carriages will not be as much affected by any slight depression or irregularity in the rails. This is likewise a consideration of importance, particularly in a country where, from the powerful action of the frost, it is so difficult to preserve a level and even surface to the road. The irregularities which may exist in the surface, will be less liable to be increased by the working and pitching motion of the engine and cars, and as the motion will be less unsteady, more uniform and regular, a favourable effect will be experienced, in contributing somewhat to the efficiency of the motive-power.

5th. Adding to the width of the track, secures a more equal bearing of the load upon each wheel, and upon the rails—the carriages are rendered more commodious for passengers, and better adapted for the conveyance of various kinds of freight, and are in all respects more safe,—the capacity of the road for business is at the same time increased,—more space is allowed for forming the horse track, and the dust and broken materials from the track are less liable to be thrown upon the rails.

The above are the principal *advantages;* now for the *disadvantages.*

1st. By widening the track, the difference in curvature between the inner and outer rails on the curved portion of the track is increased, and as it is customary to make the wheels fast to the axles, the resistance from the sliding of the wheels, &c., in passing the curves, will be increased. This is, undoubtedly, the most serious objection that can be urged. By increasing the width from 4 feet 8½ inches to 5½ feet, the sliding will only be increased the one-sixth part. *The extent of the* minimum radius of curvature in most roads, is about 400 feet. The resistance on a curve of this radius for a level road of the usual width, has been found to be about 4½ or 5 lbs. for each ton weight, over and above what it is upon a straight and level road. Assuming that the increased resistance is in proportion to the sliding of the wheels, which is probably as great an allowance, as the circumstances of the case will warrant; and we find the resistance augmented in consequence of widening the track to 5½ feet upon the same curve only 12 or 14 ounces for each ton weight, and if estimated for the average curvature of the curved portions of different railroads, will be found not to exceed one or two ounces for each ton weight, an amount too small to be put in competition with the important advantages to be derived from the greater width.

2nd. Another objection is the increased length which must be given to the turns-out. This again is an item of minor importance, the addition to the length not exceeding in each case more than 8 or 10 feet.

3rd. By widening the track, the cost of forming the road-bed and the superstructure will be somewhat increased. On a road-bed 26 feet wide, an ordinary width, this expense need not be increased for the wider track of 5½ feet more than the fortieth or fiftieth part on the average; and as it regards the superstructure, the additional expense is simply the cost of adding 9½ inches to the cross-ties, if there are any, which, if they are of wood or iron, will not much exceed 100 dollars per mile for a single track.

4th. The remaining objections are scarcely deserving of notice—they are the extra cost of carriages, and the cost of 19 inches additional width of ground. These, like the preceding which I have noticed, can have but little weight, when placed in competition with the very great and important advantages to be derived from an increased width of track.—I am, &c., SMEATON.

MESSRS. HOWARD'S AND SYMINGTON'S SYSTEMS OF CONDENSATION.

Sir,—Allow me to request such of your readers as may feel sufficient interest in the subject of controversy between Mr. Symington and myself, to place my communication in your 691st Number in juxta-position with his *answer* in your 683d Number. Turn then to his accusation of my having made a false statement to his injury as to his visit to Rotherhithe, and to the twaddle about representing "in the proper quarter" my interference with regard to the Comet—and surely it will appear that I have reason to complain of the tone of his correspondence.

I now call upon him, as in fairness I

am entitled to do, to state in your journal, without *reserve*, *where* and in *what manner* my process of condensation has been practised forty years ago. I must observe, too, that this assertion is no answer to the questions I put to him tending to place the point at issue in a tangible position; and I must, therefore, again call his attention to them.

Your most obedient servant,
THOMAS HOWARD.

7, Tokenhouse-yard, Sept. 20, 1836.

RAILWAY COMMUNICATION.

(From the *Athenæum* Report of the Meeting of the British Association.)

At the late meeting of the British Association, at Bristol, Dr. Lardner stated some statistical results arising from the establishment of railway communications. The subject to which he would call the attention of the Meeting, was one which, at the present time, was particularly interesting; but it was not for the purpose of showing how far railway speculations, as such, might become profitable, that he should bring them forward—he had a higher object, which was that of endeavouring to ascertain, and if possible, to establish the general law which governed the increase of intercommunication which they led to. He was not prepared to lay before them any particular results, as to the general effects of railways; he should confine himself to a few facts which seemed to shadow forth the probability of a statistical law in reference to the point to which he had alluded. When the Liverpool and Manchester railroad was projected, it was designed for the transit of goods only, at the rate of ten miles per hour; but it was unexpectedly found that treble speed was attainable, and then passengers became the primary consideration. Previous to the establishment of the railway, there were 26 coaches between Liverpool and Manchester, and the number of passengers making one trip was about 400 per day. Immediately on the establishment of the railway, that number rose to 12,00; thus, in the very outset, an increase took place in the proportion of 3 to 1. The railway had been in operation, he believed, since 1828, and from that period the number of passengers had gone on increasing, with the exception of the period of the cholera, which might very fairly be omitted in his calculations, and now the number was 1500 per day, being a further increase of one in four; and thus it appears that no less than half a million travel by it annually. Now, the population of Liverpool was 165,000, and that of Manchester 183,000, making a total of 348,000; and thus they would see that, out of those populations, an intercourse of more than half a million took place annually. The time by the fastest coaches was three hours: the time on the first opening of the railway was, by the fastest trains, one hour and a half, now it wes but an hour and twenty minutes. The fare of the coaches was, outside, half-a-guinea—what it was inside he could not then recollect: by the railway, the average fare was 4*s.* 6*d.* In this instance diminution of time and expense both combined to increase the number of passengers; and the increase, it should be borne in mind, was exactly fourfold. The second example he should refer to, was the railway between Newcastle and Hexham; before the establishment of which, the number of passengers by coach monthly was 1700; it is now by railway 7060, being rather more than a four-fold increase. Now, the village of Hexham was by no means an important place; on the contrary, it was so insignificant that the wonder was, what could possibly require 7060 persons to go upon the railway. His third instance would be the Dublin and Kingstown railway. The city of Dublin contained 200,000 inhabitants, and Kingstown, which was distant about six miles, contained 6000 or 7000. There was no manufactures, no trade there: true, there was a harbour, but it was used exclusively by the Post-office packets; none of the commercial vessels—not even those who might be driven in by stress of weather—being permitted to discharge their cargoes: consequently no goods were carried on this railway. Now, when he stated what was the intercourse actually existing, under these circumstances, it must be admitted that the effect exercised upon it by the packets was very insignificant. The intercourse previously existing, too, it must be borne in mind, was carried on by means of a rude vehicle called an Irish car, and in this manner they were carried at prices varying from 5d. to 7d., the proximate number being about 800 daily. The railway had been opened about two years,

and the intercourse was in the ratio of a million of persons annually. Now that furnished another example of the numerical proportion previously referred to: for if they took the number of passengers before the opening of the railway at 800 daily, it would be found that the proportion of four to one would give 3200, and 3300 was the average of the present number—the travelling on the Sunday being 7000, the proportion the other days less; but the average above given being fully made up. He had thus shown that the law of increase was fourfold; he would now show that it depended infinitely more on the saving of time than money. On the Liverpool and Manchester railway the price was less than one-half the charge by the coaches; but on the Dublin and Kingstown railway the charge of conveyance was absolutely raised, and, besides that, the railway did not reach the latter place by half a mile, which occasioned to many an additional charge for carriage-hire to take them over the remaining ground. On that railway there were three classes of trains, and the fares were 1*s*., 8*d*., and 6*d*.; the carriages most filled being those at 8*d*.; it was quite fair, therefore, to assume that, in this instance, three out of every four travelling on the railway did so merely on the score of the saving of time. It would be well if they could go back and see what were the effects produced on intercourse by the establishment of turnpike-roads and the introduction of coaches; they would find probably that the great increase had been wholly owing to the time saved by the improvements effected. It was remarkable, however, how much results varied, for he had ascertained that, though much improvement had of late years been effected in the mode of travelling by canals—in certain cases the boats having attained to a speed of 10 miles per hour, equal to that of the coaches, while they carried their passengers at a far cheaper rate—yet he did not find that they added much to the intercourse. He alluded more particularly to the boats on the Kendal and Preston, and the Edinburgh and Glasgow canals; and, he asked, could it be doubted, if railways were running parallel with them, that an increased traffic would immediately take place? *He mentioned* this merely to show how *much more* economy of time was regarded than the mere saving of money. Dr. Lardner then proceeded to remark on the value to new companies of the experience gained in working the Liverpool and Manchester railway. The charge for transport of passengers on the Manchester railway was 1.84-100ths of a 1*d*. per mile, the actual cost to the proprietors about 1*d*. per mile: whereas a Birmingham manufacturer had entered into a contract, by which the whole of the passengers on that line would be conveyed at the cost of one farthing a mile, including every expense of locomotive power, the company merely finding the carriages and the road. The same company had also formed a contract for the conveying of goods at 1*d*. per ton per mile, the contractor, as in the former case, defraying every charge for engines, &c. Dr. Lardner then proceeded to show the possibility of attaining so high a rate of speed as 50 miles per hour, and dwelt at great length on the effects likely to result to the general commerce of the country.

WIRE-PLATE ENGRAVING.

Sir,—I herewith send you a description of a proposed new mode of engraving, of my invention, to be called wire-plate engraving; and it will give me great satisfaction if you think it worthy of insertion in your Magazine.

The wire-plate engraving is intended as a substitute for wood-engraving, on account of its possessing some advantages over it, as may appear from the following description, which, in order to make clear, I propose to consider the matter under two general heads; first, a description of the wire-plate itself, and secondly, the mode of engraving upon it.

1. The wire-plate is composed of a number of very fine wires laid parallel together, and closely packed in a metal frame. In this state the wires, together with the frame, constitute a plate, whose two opposite surfaces are composed of the ends of the wires, as these are presented outwards or on each side of the plate. The wires may be about a quarter of an inch in length, or from that to half an inch, according to circumstances, and are to be of the finest steel or brass wire that can be procured; so fine, indeed, as that their diameters must not exceed 150, or even 200, to the *linear* inch; though if their diameter exceeded that

amount in number to the *linear* inch, it would be still better. I know not whether there are any practical difficulties in obtaining wires of such exceedingly small magnitude, but should there be any, I trust they may be overcome, as the resources of art and manufacture have seldom been found deficient in supplying the wants of men.

2. Let us now suppose the wire-plate to have been constructed, and to be in a fit state for engraving upon. The preparatory step is, to lay the plate down on a moveable cushion, having a plane level surface at top, where it is covered with soft leather, beneath which a blanket is stretched. In this state, if a graving-tool be applied to the upper surface of the plate and drawn over it, a sunk line will be formed, which, on turning the plate, will be found to have produced a raised edge or ridge on the other side, consequent on the depression of the wires taking place in the line of direction of the graving-tool. This effect must needs follow, because it requires a less effort for the graving-tool to press down the wires than to pass between them. It is from a number of such ridges and projections formed on the one side of the plate by the action of the graver's tool on the other side, that an engraving, similar to wood-engravings, is proposed to be taken off. Also in the progress of the work the plate may be operated upon on the one side or on the other, according as convenient, or as the artist may think good for the completion of his design.

When the plate has been fully engraved upon, the next step is, to give fixity to the wires in the places assigned to them by the graving-tool. This may be done by pouring over that side of the plate from which the engraving is *not* to be taken a composition of melted wax or resin, or some similar compound which hardens on cooling, and which will thus form an *abutment* to the wires, so as to prevent them shifting their places on pressure being applied, as in taking off the engraving, &c. It will be a point of some nicety to determine the exact degree of facility the wires should present to being pressed down by the graving-tool, and that degree of firmness or resistance required to hold them in their places on ordinary occasions. This point might be attained by causing wax to occupy the interstices between the wires, or it might be produced by their simple adherence, merely caused by their lateral pressure within the frame.

I now come to treat of the advantages which this possesses over wood-engraving.

1. Wood-engraving is allowed to be a somewhat difficult process; the chief difficulty seeming to consist in cutting out minute portions of the wood to form the light parts of the engraving. How much more simple is the mode of execution with the wire-plate, wherein the same effect is produced by simple pressure;—where, instead of the difficult and laborious task requiring to be most carefully performed, all that is required, is a momentary pressure with the graving-tool. Surely an advantage like this cannot fail of being appreciated by artists occupied in engraving.

2. Another advantage of the wire-plate engraving is, that in the event of a false stroke being made, or if in any other respect the work done be not perfectly to the artist's mind, he has the power of repairing his error immediately, by merely turning the plate and operating on the other side, either to replace the wires in their former position, to be operated upon afresh, or else by a few strokes or touches, to produce the desired effect.

3. A third advantage of the wire-plate is, that after it has served one set of engravings, or one series of impressions has been worked off the plate, it may be made to serve another set, without any assignable limits. This may be done by restoring the plate to its original state, or to the state in which it was before being engraved upon, which is thus to be effected. The ground at the back of the plate is first removed, and the plate is then to be passed under a roller, or between two rollers, so as to press back the wires into their natural order, wherein the ends of the wires constituted a plane or level surface on the two sides of the plate. These are, I believe, the chief advantages of the wire-plate system of engraving. I now come to a view of its disadvantages, or those at least which, whether well or ill-founded, it may be thought to labour under.

1. The wire-plate, it may be said, would be too expensive a construction to supersede the use of wooden blocks in engraving. To this it may be replied,

that the first expense would be all, as may be seen by a reference to No. 3 above. Besides which, let the expense of wooden blocks, arising from the continual demand for them in engraving, be considered. These two circumstances conjointly may tend to equalise more nearly than would at first be imagined, the difference in the cost of wire-plate and blocks of wood.

2. Another objection to the wire-plate system would be, that by these means no even or distinctly marked line could be impressed on paper, but that all such lines would be jagged and rough at their sides, or otherwise could only be marked by a succession of dots. The force of this objection is very considerable, for certainly no *line engraving* could be executed by the wire-plate. However, this objection does not hold good generally, or it cannot be considered quite fatal to the plan proposed, as, if so, it applies equally to every system of engraving, excepting that performed in the line manner. Now there is a style of engraving on copper which is not performed by lines, but by dots, and which, although perhaps not equal to line engraving, is still very beautiful in its way, and is certainly preferable in point of execution to any system of wood-engraving extant. The decision, or accurately defined impression of metal over wood, gives it certainly the preference where it can be employed; and this end, I think, may be attained by substituting wire-plate for wood, in the particular mode of engraving for which both are adapted.

3. A third objection to the wire-plate may be its inability to indicate *very fine* lines on paper, as every such line must have a breadth equal at least to the diameter of the wires entering into the construction of the plate; and that in many cases the line will have a double breadth alternating with a single, according as the graving-tool shall take over one or two wires in succession. The only answer I can give to this objection is, that the wires are proposed to be so excessively small or minute in diameter, as to render the practical difficulties of the case, as here stated, a matter of very little consequence.

I believe I have now stated all that may be said, of chief importance at least, *pro and con*, respecting the wire-plate system of engraving; and I leave it to you, Mr. Editor, and your readers, to determine to which side the balance leans. In the mean time, yours, &c.

V. W. Gardiner.

NOTES AND NOTICES.

Patent Law.—"Sir, You will very much oblige an old subscriber, by giving him your opinion upon the following point:—A master has had a machine at work in his factory for five years, but had not thought it worth patenting. He finds, however, that another person has lately taken out a patent for the same thing in principle, and with only a few alterations in the construction. Can the patentee stop the previous inventor and user from working his machine?—Your humble servant, N. B."—In answer to our correspondent, we refer him to the following extract from the Patent Law Amendment Act:—"And be it enacted, that if, in any suit or action, it shall be proved or specially found by the verdict of a jury, that any person who shall have obtained letters patent for any invention or supposed invention was not the first inventor thereof, or of some part thereof, by reason of some other person or persons having invented or used the same, or some part thereof, before the date of such letters patent, or if such patentee or his assigns shall discover that some other person had, unknown to such patentee, invented or used the same, or some part thereof, before the date of such letters patent, it shall and may be lawful for such patentee or his assigns, to petition his Majesty in council to confirm the said letters patent, or to grant new letters patent, the matter of which petition shall be heard before the Judicial Committee of the Privy Council; and such Committee, upon examining the said matter, and being satisfied that such patentee believed himself to be the first and original inventor, and being satisfied that such invention or part thereof had not been publicly and generally used before the date of such first letters patent, may report to his Majesty their opinion that the prayer of such petition ought to be complied with, whereupon his Majesty may, if he think fit, grant such prayer; *and the said letters patent shall be available in law and equity, to give to such petitioner the sole right of using, making, and vending such invention as against all persons whatsoever, any law, usage, or custom to the contrary thereof notwithstanding.*" In the Bill the following exception was here added:—"Save and except such person or persons as did use the same invention before the date of the first letters patent." This saving clause was, however, lost in the passage of the Bill through Parliament.—Ed. M. M.

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A complete list of Patents from the earliest period (15 Car. II. 1675,) to the present time may be examined. Fee 2s. 6d.; Clients, gratis.

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BRUNTON'S PATENT GAS RETORT.

Fig. 5.

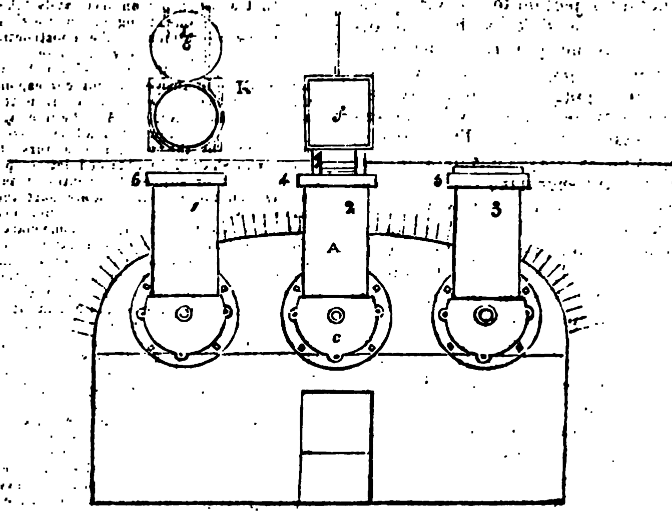
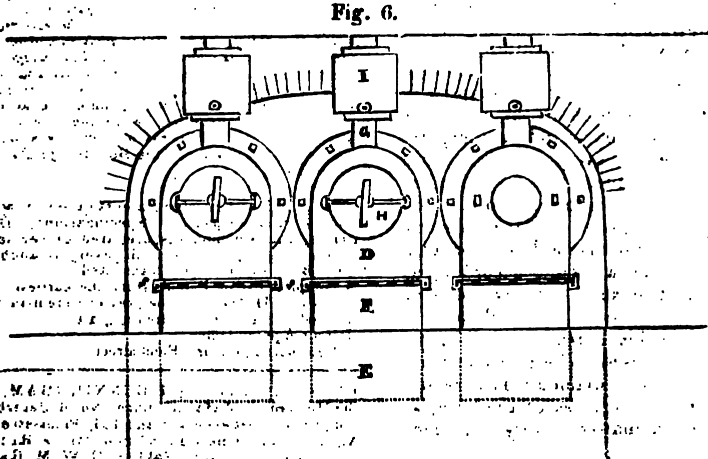


Fig. 6.



BRUNTON'S PATENT GAS-RETORT.

Fig. 1 is a section of a retort with the various parts attached, viz. a feeder or hopper, A; a plunger or piston-case, B; a round taper retort open at both ends, C; an end piece, D, with a discharge-cylinder or shoot, F; and an exit pipe, G. The same letters indicate corresponding parts throughout.

The lid or cover *f* of the feeder A being raised, a certain portion of coal is introduced, and falls on a plate of iron or diaphragm *n*, and the lid closed, the lip of which falls into a narrow trough, *b b*, filled with fine sand, loam, or any compost, which will render it secure. The hollow piston or plunger *a a* in the case B is then propelled forward, either by a screw turned by a handle outside, as in fig. 1, or by a rack and pinion, as in figs. 3 and 4. By this mode a quantity of coals is forced from the space immediately before the piston and under the feeder into the retort, and the whole bulk moved forward, while that which has been carbonised and lies at the further end is discharged into the end-piece D and through the shoot F into a cistern of water E, from whence it may be removed by a rake or basket; the piston is then drawn back into the case, and the diaphragm *n* let down by slacking the spring catch *i* which confines the handle *h* (see figs. 2, 3, 4), so that the coal just introduced may drop into the space between the retort and piston, thereby shielding the apparatus from the heat, and being ready to be moved forward when a fresh charge may be required; the quantity and frequency of each charge must depend upon the quality of the coal used and the size of the retort. The gas passes through the exit pipe G, on the flange of which is a circular box I, furnished with a small cone or taper pipe, which is placed immediately over the aperture of the exit pipe, so that all the condensible matter may be prevented from falling on the coke in the cistern E by being deposited in the box I, outside the cone, from whence it may be removed when required by a tap or plug. The end-piece D is furnished with a small cover or lid H, which may be at any time removed for the purpose of examining the interior of the retort; it is secured in its place by a cross bar and screw.

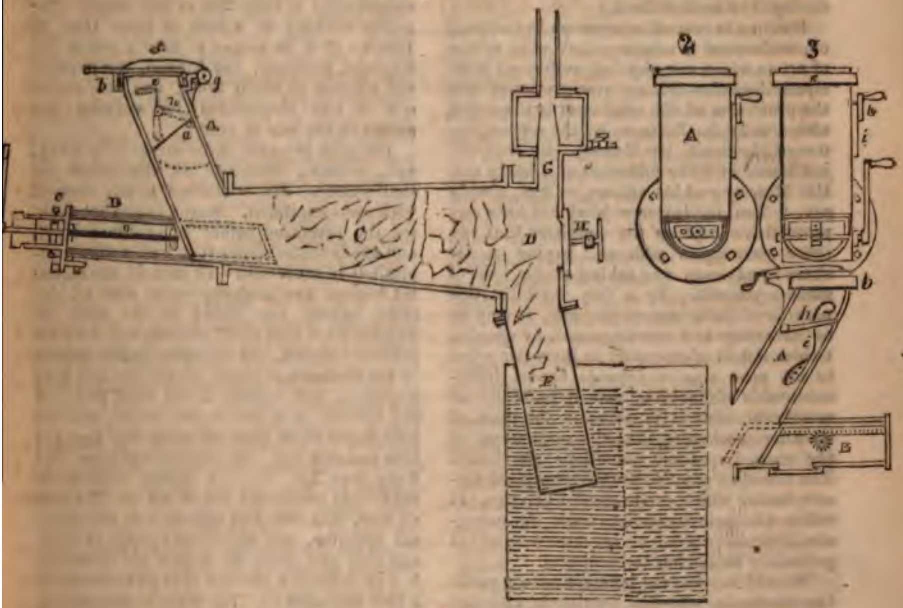
Fig. 5 represents a front view of three* retorts in one bed. No. 1 is furnished with a slide-valve L, the seat of which, K, being a fixture and secured by cement, obviates the necessity of frequently changing the luting in the trough *b b*. No. 2 shows the lid *f* open, and thereby exhibits the hinges upon which it works. No. 3 is closed.

Fig 6 is an end view of the same retorts with the exit pipes G, boxes I, and lids H. The lid of No. 3 is off for the purpose of inspection.

The superiority of this retort above those in common use, consists in the facility with which it may be charged and discharged; the almost total absence of that suffocating and enervating heat and smoke necessarily attending the present system; the economy in the cost of wear and tear, as the middle of the retort only is exposed to the action of the fire, and iron barrows, rakes, &c. are entirely dispensed with; the saving of labour, and consequently wages, as any man or even stout boy, whatever his previous occupation may have been, may after a day or two's practice take the whole management of from fifteen to twenty-five of these retorts; the preventing that immense loss of gas which takes place when the retorts are charged; the more equal carbonisation of the coal, arising from the frequent agitation of it in its progress through the retort; and the whole process being uninterrupted by the admission of atmospheric air.

* One, two, three, four, or more retorts may be put in one bed.

Fig. 1.



ON THE LAW OF PATENTS. BY JUNIUS REDIVIVUS.

(From the *True Sun.*)

After all the long disputes between the respective representatives of capital and labour, the question seems to have settled into a mutual conviction that they are necessary to each other, and must each be affected by the prosperity or adversity of the other. Yet notwithstanding this the existing laws are alike inefficient for the protection of either capital or labour. It is no uncommon thing for a partnership business to be carried on for a series of years, whereby a large capital is accumulated, and which by some absurd dispute between the parties is thrown into the Court of Chancery, there to be dispersed amongst the professors of the law and their various retainers. And all this might be prevented by the simple and efficient tribunal known in France as the Chamber of Commerce. A summary and cheap mode of reference is needed for those suffering under injustice. But great as this evil is on the capitalists who have accumulated property, there is an evil pressing yet more heavily on the workers who seek to accumulate property. There is no efficient protection for the mental labour on which all that is valuable in society depends. The capitalist is protected *from direct encroachment* on his property; *the labourer* and the working mechanic are protected from any direct encroachment on their wages, or on their bargains for remuneration; but the *originators* of every class are so imperfectly protected, that they are exposed to both the direct and indirect plunder of all classes alike. This is a most unwise national policy, inasmuch as national progression must ever depend upon originators. Take away the originators from amongst us, and we shall become a stagnant nation like the Chinese. If, therefore, the nation desires to make progress, its wisest policy is to foster the originators, and hold out to them all possible inducements to follow the bent of their genius. It is quite true, that even if left to themselves, and exposed to hardships and injustice, they cannot quite repress the fire that is in them; but it is also true that the produce will be lessened. The field which is left uncultivated will in time be choked with weeds, though straggling plants may at intervals appear amongst them.

The principle on which the nation professes to protect the mental labour of originators in the case of books, is national advantage. Few persons would produce valuable works if the copyright were not secured to them; yet even in this case a heavy tax is exacted from the authors in the shape of a considerable number of gratuitous copies. And after all, if the work be popular, an unprincipled

bookseller has it in his power to pirate it in the shape of an abridgment, or by reproducing it in another form.

But in the case of originators in chemical or mechanical invention—that wide sphere of art on which our physical well-being principally depends—it is not even pretended that the protection of the originator is the object aimed at by the State or by the representative of the State, his Majesty—the only object aimed at is the collection of a heavy tax. His Majesty and his officers, in fact, simply say, "You, the inventor, shall not have any protection except on the condition that you share your gains with us," paying us our share in advance, and taking all the risks of success yourself. To a rich capitalist this may be of little importance, nay, it may be an advantage to a certain extent, by opening to him a field of monopoly in invention—but to the poor man it presents almost insurmountable difficulties; and it must be remembered, that it is amongst the class of working mechanics that the originators of the most important inventions are found. The school of practice presents continual circumstances which excite mental activity. It will not be uninstructive to trace the successive difficulties which an inventor destitute of pecuniary means has to encounter.

We will suppose the inventor to be a working mechanic, who has sedulously attended the lectures of an Institution, and read all the books within his reach. An idea suddenly strikes him of the practicability of effecting some mechanical improvement. He convinces himself by a drawing that his idea is correct, and proceeds, during hours stolen from his meals and sleep, to construct a model, if perchance his pecuniary means will enable him to purchase the needful materials. The model is successful, and he proceeds with it to a patent agent, who praises it highly, and recommends a patent to be instantly taken, but slackens rapidly in his praise as soon as he finds that the inventor is destitute of cash. The poor mechanic asks what the expense will be, and he is told that to secure a patent for England alone, the fees will amount to the following sum:—

	£	s.	d.
Entering caveat at Attorney and Solicitor-General's office......	1	0	0
Fees at Secretary of State's for reference......................	2	2	6
— Attorney-General's for report	4	4	0
— Secretary of State's for King's warrant....................	7	13	6
— Attorney-General's Patent-office for Bill, &c.............	15	16	0
— Secretary of State for Sign Manual......................	7	13	6
— Privy Seal..................	4	2	0
— Lord Chancellor's Patent-office for Great Seal, and extra for Private Seal..............	50	17	0
Stamps..........................	9	0	0
Fees for enrolment.............	5	13	4
	108	1	10

In addition to this, the solicitor's bill will amount to some 20*l.*, and the drawings and specification to some 20*l.* or 30*l.* more, altogether making up a sum of from 150*l.* to 160*l.** If it be wished to take a patent for England, Scotland, and Ireland, the expense will amount to about 300*l.*, and this exclusive of any preparation for working the patent in the way of trade.

The poor inventor turns sorrowfully away, and, perhaps, returns to ask what course he shall pursue. He is advised to ally himself with some capitalist. But a capitalist must see the invention before he can join in it, and the inventor shows it to half a dozen capitalists in succession—all men of the strictest honour and integrity—but who all decline having any thing to do with it. Disconcerted with his ill success, and with his pockets emptied, the inventor again applies to the mechanical trade, which he had long neglected, and repines at his hard fate. A few months, or a year or two elapse, and the poor fellow finds that his invention has got into common use. He makes inquiries, and finds that Mr. ——, a highly respectable man—has obtained a patent for it. He calls on him, and tells him that he was the original inventor, and Mr. —— laughs at him, and bids him bring his action for damages. A man without a shilling is to go to law with a rich capitalist!!! The poor inventor may perhaps contrive to get a friendly opinion, which is of little avail. The patentee has sworn that he is the original inventor, and as he has actually brought the invention into use first, the law protects him in the use of it, and at most permits the real inventor, after very strong evidence, to use his invention himself, without the right to sell it. And thus the poor man beholds another accumulating riches from the fruits of his labours, while he himself is condemned to poverty. And this is unavoidable, as the law at present stands. The first applicant for a patent is the first served, and as the condition on which a patent is granted is the previous secrecy of an invention, it is not possible to convict a patentee of piracy if he possesses only ordinary intellect to cover his dishonesty. But if the first applicant were not protected, every valuable patent would be claimed by crowds of dishonest people, as their original invention.

Time has passed away, and our poor mechanic has accomplished a second invention. He has endeavoured to be very secret with it, but the size of the model and the inconvenience of the lodging wherein he has prepared it, have made known to many of his associates and various projectors, that he has a scheme in hand. He is as cautious as pos-

* The proper charges are not so high as here stated, by at least 30*l.* As it is, however, they are enormously oppressive.—Ed. M. M.

sible; but still something lurks out. Reputation has attached to him from the success of his former invention, which is known to be his, though another has benefitted by it. He finds a capitalist with comparatively little difficulty, and applies for a patent. In the simpleness of his heart he chooses a title which correctly designates his invention; his patent passes the Great Seal, and he considers his fortune to be made, and the necessity for further secrecy done away. At the end of six months he enrols his specification, and with his partner in the patent proceeds to carry on business. Scarcely has he commenced, when he receives a notice from the solicitor of Mr. ——, that an injunction for piracy will be moved against him in the Court of Chancery, unless he ceases from his proceedings. He then learns for the first time, that previous to his application a patent had been taken out, the title of which was couched in such general terms, that while not supposed to relate to the same thing, it was in reality nothing else, and the specification had been made out from information gained through the treachery of one of the workmen employed by the poor inventor. He has again been ruined, and the capitalist who has sustained a loss through his means overwhelms him with reproaches. The only advantage the inventor has reaped is the knowledge that the safe mode of making a title for a patent is to leave it so vague that it may mean any thing, and so definite that it may cover the object aimed at. Exquisite employment for the warped mind of a lawyer!!!

The fame of our inventor has increased, but his pockets are low, and he is reduced to work at his trade as before, but after all his ill success, the consciousness of merit, and a mind too ardent for meanness or avarice, bears him up. He feels that all he has done is not lost to the world, and it enables him to sustain his disappointment. Time rolls on, and accumulations from his earnings place him in a situation of comparative ease, when his mind again emerges "beyond the ignorant present." His conceptions take a wide range, and his imagination flashes upon higher objects. It takes a tangible form, and a machine is devised which will supersede the labour of many men. Slowly and wearily he moulds his crude ideas into shape, and drawing after drawing is made till a result appears in a working model. His heart laughs while he contemplates it; he feels that he has raised himself to affluence, to merited leisure. After long search, he meets with a partner who will advance the needful funds, and take a share of the invention as a patent. He applies for his patent, and gets notice that a caveat has been lodged, occupying the very ground he was about to take. The right to a patent under such a title as he has chosen, is, in short, disputed, and he has to contest the matter with an opponent. The Attorney-General is referred to, to examine the different inventions, and he, after comparing the plans, pronounces his decision, that they are so entirely different, that both parties are at liberty to proceed, as they will not interfere with each other. Satisfied with this, our inventor's mind is at ease, and he proceeds leisurely with his patent. His fees are all paid, and he believes that at last he has accomplished, as well as deserved success. But he is again doomed to disappointment. His opponent has sealed his patent a day before him, and is first entitled to specify, which he does on the last day of the six months. Horror-stricken, our inventor discovers that his opponent has specified the same invention that he himself had prepared. He cannot understand this, as the Attorney-General had declared the two inventions to differ. He asks legal advice in the difficulty, preparing by evidence to support the fact of his own plans existing, and the fact of the Attorney-General declaring those of his opponent to differ; but he is cut short with the information that no records are kept of the Attorney-General's decisions, and therefore they cannot be brought forward. He has no remedy—he is once more deprived of the benefit of his own exertions by nefarious practices, owing to the inefficiency of the law.

Years have elapsed, and our well-deserving, but ill-rewarded inventor has passed the middle age of life to tread the down-hill path, still a working man, sobered but not desponding. He has learned experience, but he has not lost hope. All that he has planned has produced the results he expected, though for the benefit of others. His predictions have all been verified by experience. He has another and a last plan in agitation, which he fondly hopes will compensate him for all past disappointments, and he has the consolation that it is more important than all which have gone before it. Warned by former difficulties his caution is great, and he carefully weighs the repute of the persons to whom he applies himself. His invention consists in improved machinery for cotton-working, and one of the largest capitalists in the trade joins him. On applying for the patent he finds a caveat entered before him. With considerable difficulty he finds out the individual who has entered the caveat, and he feels sure that he knows nothing whatever of machinery. But no matter, he is the first in the market, and our inventor is baffled. But from this difficulty he is at once rescued by his partner the capitalist, who pays the caveat-holder from one to two hundred pounds, to forego his claim. At length all is completed, and the hopes of the inventor seem accomplished beyond the reach

of destiny. All fees are paid, and the patent is signed, sealed, and delivered. To work it is now the object, but his partner, for some reason or other, causes delays from time to time. Our inventor cannot understand it, but at length the truth bursts on him. This partner is the owner of machinery in which large capital has been just embarked, and he has taken a share in the patent as the readiest mode of quashing it, as its introduction would have destroyed the value of the machinery he already possessed. Our inventor is ruined, and his only remedy for this grievous wrong is to file a bill in Chancery, *i.e.* a man without a shilling is to enter into a legal contest with a rich man, which contest is in itself interminable, unless by the agreement of both parties. It is a mere mockery of justice, and the man who has committed this grievous wrong laughs with impunity at him who has sustained it.

Hope deferred, it is said, maketh the heart sick. The mind of an inventor is usually of a sanguine turn, but repeated failures from causes beyond individual control, have a tendency utterly to destroy hope. In the downward path of life, the elasticity of the spirit declines, and our inventor no longer struggles with his destiny, or at least with the doom, which, pronounced by unjust laws, seems to him destiny. Thenceforward, he seeks to gain a mere living by the labour of his hands, and no more. The struggle for leisure he leaves to the younger and more fortunate.

Seven more years have elapsed, and the patient quiet of our inventor is again disturbed. His partner in the patent has found that with his existing machinery, he cannot compete in the market, and he wishes to bring the patent into use. He proposes terms of partnership, hard enough to the inventor, and the inventor refuses them. A better offer is made, and with fear and anxiety—knowing he has to deal with a rascal—our inventor at last becomes a manufacturer. He is at last what he should always have been, a director of other men, lacking only a skilful leader to make them efficient. The processes of manufacture absorb the whole of his attention, he receives a stipulated monthly sum for his subsistence, and forgets that in a manufactory business, there is a department of accounts as well as of the conversion of materials. To the accounts his partner attends, and after several years have elapsed, our inventor finds himself in difficulties and disputes. His partner has devised a systematic plan for appropriating to himself a profitable business, and by harassing a simple-minded man he is at last successful. Our inventor retires from disputes and further anxiety with an income barely sufficient to save him from the necessity of manual labour.

It is often charged against inventors that they are mere schemers, that they project plans whose details they are incompetent to fill up. This charge is frequently true, but it can be no excuse for placing the deserving inventor on the same footing with the mere schemer. The steam-engine of Watt is an universal benefit to society, though the steam-gun of Perkins is useless; and the railroad between Liverpool and Manchester will not cease to be valuable, though that between London and Southampton should prove a waste of money. The truth is, that inventors abound in imagination, and where they happen to be without the restraint of judgment, they commit blunders; but what then? Is it better that blunders should be occasionally committed, or that the world should stagnate? The answer must be found in the principle of utility.

It will not be questioned that invention is a good, and therefore it would be a wise thing on the part of the nation to foster invention in such a mode as to produce the greatest amount. This mode is by making it the interest of the inventor to prosecute useful discoveries, by protecting his interests in every way which may not trench on the rights of the public; by removing every obstacle to his progress, and preventing the necessity of his wasting his time on matters foreign to the bent of his genius, for there can be no doubt that all time so wasted is a loss to the inventor individually, and to the public generally. But, while we carefully protect the interest of the inventor, we must take especial care that knaves, assuming the garb of inventors, may not acquire patent monopolies for productions of art which are not original; and this point brings us to the classification of inventions.

Inventions generally may be at the outset divided into two classes—first, new machines for the supersession of human labour in branches of art or manufacture already known; and, secondly, for new commodities or adaptations of new materials, to produce articles of human convenience not before known. But as the faculty of imagination is not commonly united to perseverance in details, it frequently happens that patents are secured for inventions, which the inventors fail to bring into common use. And thus the public is virtually deprived, in many cases, of articles of exceeding utility, for no one will bestir himself to render perfect an invention, from which he cannot hope to reap a remuneration. The inventor has stumbled on an idea, with which he has proceeded sufficiently far to secure him a monopoly, but has, in truth, left by far the most difficult part of the process unaccomplished. The French have wisely regarded this difficulty, and therefore their Patent Law permits a man not only to secure a patent for

ginal invention, but also for *perfecting* vention of another. The *perfecting pro-* really an original process, as well as f producing the first idea. In a humor- ecdote, a Frenchman is described as claim to the invention of a shirt-frill, he Englishman, who overheard him, his claim to *perfectionating the inven-* y adding the shirt itself!

entions for labour-saving machines are, se, the most profitable to the inventors, e consumers are always willing to pur- known commodities, more especially they can be furnished at a reduced But he who invents a new com- y, has to struggle with the difficulty of ng a new market. The public are, as y—and perhaps not unwisely, in the e of evidence whereon to judge—sus- s as to the qualities of new and untried s. They have only the bare word of entor as a voucher, and they may very ably mistrust it, while quoting the pro- "No man proclaims that he sells stale It is by slow process and unwearied on that a new article is brought into ive use; and thus only—in the absence duly trained judgment—is the public d to guard itself against being gulled. refore, under the existing Patent Laws, fession of an inventor of labour-saving nes may be a valuable pursuit, if he oid being cheated; but the profession inventor of new commodities is utterly ess in a pecuniary point of view—I to inventors who invent for the pur- f selling their inventions, and not of ng them. The mode in which newly- ed commodities mostly benefit the in- s is by their embarking in business as acturers. In this mode a new business e established by the publicity afforded, old-established business which is fall- f may receive an additional impulse. this principle it is that persons engaged iness occasionally take patents, consi- that if the patent itself produces no those who may be attracted by curio- ay become customers for other articles. n short, a complicated mode of adver- and the public is exceeding apt to be- hat a man who has taken out a patent, for a worthless invention, must pos- ore than ordinary abilities in the com- un of business, *i.e.* there is a vague revalent, that no man would presume nt an improvement in any branch of til he had at least become thoroughly ant of all the ordinary processes. For ason it is common for inventors who atented new machines thenceforth to emselves Civil Engineers, as though t of having become acquainted with a particular branch of art had made them competent to all branches; as though the invention of a new pump could give a man an instinctive perception how to erect a steam-engine.

It is the interest of the inventors of new commodities to make their inventions as public as possible, but the contrary is the case with the inventors of labour-saving machines. They are interested in keeping their inventions as close as possible. The law imperatively requires of them that they shall make their invention patent, *i. e.* that they shall deposit a written specification and descriptive drawings in a public record-office; and this they endeavour to comply with in such a mode that they may overwhelm the understandings of those who strive to comprehend them under a mass of useless verbiage, whose type is to be found in law documents, and under a profusion of drawings, which, in their multiplicity of details, obscure the vision, and divest the attention from the important features. And when the invention is thus patented, it is used as much as possible in private. No desire of fame prevails over the receipt of wealth. In silence, and as much as possible in secrecy, the invention is worked; and thus it is that large fortunes are accumulated in manufacturing towns, with a rapidity astonishing to those who are not in the secret. Instances might be adduced of factories where scores of machines are used, each earning from 50 to 80*l.* per week, and going on for years without being encroached on. And this is not difficult to explain. The records and specifications are kept in London; and whoso may wish to examine them must make a journey to London for the purpose, or he must pay heavily for copies of the specification and drawings. And this few people are willing to do, unless in especial cases. The records of patents are, in truth, sealed books, except to a few individuals. If a poor man wishes to examibe a specification, even to guard himself from infringing it, he cannot find out which of the three offices it is inrolled in but by paying a fee at each in turn, and it is a chance if he takes the right one first. And when it is shown him, he is not permitted to make any extracts. He must trust to his memory alone, unless he can pay for an office-copy, and this is rarely within the means of a poor man. The object of the specification is not merely to verify the claim of the inventor. The word *patent* indicates that it is meant also to be a reference for the public, who may use the invention after the patent right has expired. This last condition is not complied with. In new commodities the public are sufficiently instructed by their perfect publicity; but it is not uncommon

for processes secured by patent right to be maintained by many long after the patent right has expired. In truth, in some cases that patent merely serves as an advertisement, and the specification is purposely falsely made.

If all persons exercising the functions of government were just, intelligent, and, above all, responsible—if, in short, the possibility of undue influence could be abolished, the most desirable mode of recompensing inventors would be by premiums paid by the state; or if that be objected to, as making the whole nation pay for commodities used only by a part—then the premiums should be collected in the form of a tax, levied on those manufacturing or dealing in the new commodity, or using the labour-saving machine. The advantage in this would be, that the manufacture instead of being confined for the space of fourteen years to the means of a single individual, or a small partnership, would become extended through the community more rapidly. It may be objected to this, that an inventor, being interested in the success of his invention, is more likely to bring it to perfection by his own concentrated efforts, than will be the case, when manufacturers generally work it on the principle of competition. There would be more force in this objection if it were proved to be the case that inventors were commonly perfectors also of their inventions; but such not being the fact, the objection is of little moment. The truth is, that inventors and perfectors would have a far greater stimulus to exertion when sure of compensation without the necessity of becoming either merchants or manufacturers. They would labour in the vocation for which they are fitted, without the feelings of anxiety, lest they should be driven into vocations for which they are entirely unfitted. The inventions which should be entitled to the premiums might be determined by the extent of their utility, in the broadest sense of the word; as for example, by the number of hands, or the amount of capital they might give employment to. And the proportion of premium which each particular invention should claim, ought to be determined by the extent. The inventor of an improved steam-paddle, for example, ought to receive a far higher per centage than the inventor of an improved railway-carriage; because the steam-paddles are few and the railway-carriages many, yet, on the efficiency of the steam-paddles many human lives may depend, while the railway-carriages may merely be a question of pecuniary saving. To regulate these various compensations would be the employment of properly appointed responsible officers.

But as we are not likely for a very long period to possess a government sufficiently responsible to be entrusted with a task, in which very high intellect and a rigid sense of justice is requisite, we must consider what is the best mode of securing to inventors a monopoly of the results of their skill by the process of patent right.

It is clear that originality alone can be the just plea for such a claim—*i. e.* the invention must be something not previously known. To ensure this the first condition must be, that the inventor has not in any way published his invention, for the recognition of any claim, after such an act, would throw open a door to a large amount of chicanery. But as there are some inventions which are not capable of being verified in drawing or model, they must be actually constructed of full size, and proved. To do this, in the case of large machines, such for example as locomotive vehicles, is impracticable with secrecy. The patent must be secured before the experiments are tried. At present this costs upwards of a hundred pounds, which money is not returned if the experiment prove a failure. The proper plan would be for the inventor to deposit a design or model, sealed up, in a record office, where the date would be attached to it, and a certificate given. And the only fees chargeable for this should be of such amount as to just cover the office expenses. After this the inventor would securely proceed with his experiments for a given time, regulated according to the title of his invention and the magnitude of the work. If his experiments remained incomplete at the expiration of the term, he should then be at liberty to make a new deposit of his plans, with a fresh date, the old one becoming invalid, as against other claimants. The experiments being complete and satisfactory, the inventor should then be allowed to take a patent perfectly simple in its form, and needing no signature from "His Majesty," or the Lord Chancellor, or the Attorney and Solicitor-General, or Secretary of State, clogged with the condition of finding certain of these personages in conjunction at the time of signature. The proper person to sign the patent would be the registering officer, who should always be visible during proper business hours. For the patent thus completed no fees should be charged in the form of a tax. But, previous to the signature, an examination should take place, to ascertain whether the specification and drawings—which should be deposited at the time of signing and sealing—corresponded in all essential particulars with the drawings or models originally deposited; if not, the patent should be refused. If granted, the fees charged should be only of such amount as to cover the office expenses.

An objection may be alleged against this system of granting patents without expense, that they would multiply in amount to a mischievous extent—that the whole ground of improvement would be occupied by designing schemers, not intending to work inventions, but anxious to make a profit by selling previously secured rights to men really intending to work. This difficulty occurs also under the present system, and although the exaction of high fees certainly has a tendency to prevent the schemes of rogues being so widely extended, yet, at the same time, it offers almost insurmountable obstacles to the pursuits of poor but worthy men. It is clear that if men could make themselves masters of certain rights—probably profitable ones—at a small expense, many would be the claimants; but it would not be difficult, and without injustice, to put a check on this. After the lapse of a certain period of time from the date of the patent, the patentee might be called on for a certain amount of fees proportioned to the extent and value of the invention, and in default of payment his patent should become void, and the right accrue to the public at large. If the patent were worth any thing the fees would be paid, and if it were worth nothing, the inventor would lose nothing but his time and the small sums paid as fees of registration. Under such an arrangement patents might be made a source of very considerable revenue to the public, which being raised from newly-created wealth, and not from overburdened industry, would not be obnoxious. The same principle should be applied to patents, which ought to be applied to public water, or gas, or railroad companies. The public grants a monopoly in a thriving business, and it has a claim to some advantage in return, but it would be hard indeed if it were to claim contributions from the companies, before they had commenced working; before they were making a profit. It is true that the inventor renders the public a service, by producing a new commodity or labour-saving machine, but when he obtains a monopoly he closes the door against the chances of any other person inventing it. In the space of fourteen years it is probable that large numbers of persons would be engaged in working out the same idea, and many of them might be successful, but if the first obtains the monopoly all the others are thrown out. Whenever any new invention engages the peculiar attention of the public, numbers of patents for similar things follow in its train. The great hardship is, that while some inventions are enormously and disproportionately recompensed, and others of probably equal utility do not repay the inventor his outlay, the same amount of tax is collected from all alike. This system operates rather to retard invention than to make it an efficient source of revenue.

It is a maxim in English jurisprudence that every man is bound to know all the laws, *i. e.* every man is liable to all the penalties incurred by breaches of the laws, even though it is in some instances morally impossible to know them. This is a difficulty which cannot be altogether avoided, for it is clear that if pleading ignorance were held a sufficient answer, it would be difficult to convict any one. The penalties of the laws would become mere nullities. But it is at least the duty of legislators to take all possible pains to promulgate a knowledge of the laws in every practicable mode. And thus in the case of patents it should be the duty of the legislative body to remove all difficulties from inventors arising from circumstances over which they have no control. An inventor requires to know what ground has been trodden before him, or he will waste his time unprofitably in re-inventing. It is usual for patent agents to possess lists of all the patents which have ever been taken out, and to these the poor man cannot get access. A public record office should possess this work of reference, as to titles; and yet more, it should possess a descriptive catalogue properly classed. With such a guide, the valuable time of an inventor would be saved, and his spirit remain unbroken; and if any inventor applied for a patent for any thing before done, the registering officer ought, as a matter of duty, to point it out to him, when refusing to comply with the application.

Grievous indeed are the hardships under which the poor inventor labours. He has no hope of raising himself above daily labour, but by his knowledge and skill; and yet, although he may exercise them for the benefit of others, he may not reap himself any corresponding advantage. The patent laws, as at present existing, are a contrivance whereby a capitalist may increase his capital, but which leave the poor inventor wholly dependent on the capitalist. He who is already helped may help himself, while he who needs help cannot procure it. This blot should forthwith be removed from the national escutcheon, or the shield of freedom which Britannia is made to wear under the cap of liberty, must be held but as an escutcheon of pretence. Give to the mechanics fair play, and the nation will soon find the advantage of it in the compound progress which will be made in all the arts tending to human convenience or human happiness. It is a claim of policy upon the worldly wise, and of justice upon the high-minded.

TRACTABILITY OF BALLOONS—COMPARATIVE SAFETY OF MONTGOLFIER AND GAS-BALLOONS, &c.

Sir,—Your correspondent, "Umbra Montgolfieri," takes, on the whole, a fair view of the ballooning subject of my last communication; but *some* of his remarks and facts require emendation.

I do not state that no degree of motion whatever can be imparted to a balloon through the "vigorous manœuvring" of properly constructed flappers by the persons in the car. But it must be in a *perfect calm,* such as "Umbra" himself says that Messrs. Roberts were favoured with in June, 1784, when they travelled 2000 yards in 35 minutes by means of their oars. This *may* be; but I should like to have *seen* the operation! I have a shrewd suspicion that the air was not *perfectly* quiescent; and that what little motion it had was in favour of the rowers. "Umbra Montgolfieri" did not *see,* either this operation or that of M. Testu; I wish he had! The flying gods and devils of our pantomimes are seen to "apply themselves most vigorously to manœuvring their wings;" but I doubt its being through their aid that they fly from one side of the stage to the other!

With regard to the comparative danger of the fire and the gas balloon, "Umbra" is not quite correct in cases which he quotes. Pilatre de Rozier lost his life by ascending with a double, or rather with two balloons—one of hydrogen gas, the other *à la Montgolfier*. In this strange conceit, I forget which of the two he placed uppermost, but the fact was, that the gas caught fire and exploded so as to destroy the whole concern. I have no encyclopedias to refer to, but I remember, thirty years ago, reading the account of this catastrophe, as given in the *Philosophical Transactions* by Mr. Cavallo, the electrician and chemist, who was an eye-witness of it. When Blanchard and an Englishman passed in a gas-balloon from Dover to Calais, they were dragged through the water more than half of the distance; although, to increase the buoyancy of the balloon, they divested themselves even of their clothes.

Madame Blanchard was killed at Paris (in 1816, I think) through the gas taking fire. It is true, the car was illuminated, and I think she had some fireworks to *throw down!* *Mademoiselle* Garnerin, whom I also knew very well, shared a similar fate, though I do not remember the particulars. Her father, Garnerin, a professed aeronaut, came to England some years ago, about a *pasteboard gun* (!) of his invention.

The most distinguished of all the early aeronauts was the rich and scientific experimenter, Count Zambeccari, of Bologna, who was a near relation of my father. The Count constructed several balloons, both *à la Montgolfier* and gas. At that time it was a serious expense to fill a balloon with gas, which was obtained by the decomposition of water by means of iron and sulphuric acid. I have above noticed the circumstance of Blanchard and his companion having been dragged through the water, on their way from Dover to Calais. I now mention the name of Zambeccari, in order to draw the attention of your intelligent readers to a circumstance which it would be well to investigate, before our aeronauts again venture in a gas-balloon to cross the sea. This distinguished experimentalist made several ascents in a Montgolfier balloon, with which he exhibited the faculty of continually rising and falling in a most satisfactory manner. With his gas balloon, however he was twice in imminent danger of perishing. A south-west wind carried him from Bologna over the Adriatic sea. No sooner had the balloon got fairly over the water about six miles from shore, and although it was at the height of 5000 feet, it suddenly began to descend. In vain did the aeronaut hasten to throw out his ballast, for notwithstand- the ejection of every particle, together with some provisions, bottles, extra clothing, and even barometer, thermometer, &c., the car soon touched the water, and Zambeccari, half drowned, was taken up by his boats. Struck by this apparent anomaly in aerostatics, and with a view of discovering some circumstance that might account for the fact which he had witnessed, Zambeccari, nothing daunted, made another ascent, with a south-west wind which speedily put him on his way to shores of Dalmatia. He had some fast going feluccas to attend him, which, with all canvas set and nimble oars, followed him with almost the swiftness of the sea-gull's flight. The balloon was kept as full of gas as safety from expansion would possibly allow. But all

would not avail—every grain of ballast had been thrown out, besides all other objects, as on the former occasion: the balloon descended on to the waters, as though overcome by an invincible attraction, and the intrepid philosoper, many miles a head of his friends in the feluccas, was dragged along with little hopes of being overtaken. I forget whether he was overtaken by one of his own boats, or rescued by some other vessel. He remained, however, so long a time in the water, or rather "between wind and water," that his hands and feet were "frost-bitten," and his health impaired for a long time after. I do not pretend to furnish any clue to the explanation of the above phenomena, whcih we here see repeated on three very marked occasions. *Perhaps* it is no phenomenon at all, but was merely the result of accidental causes, which escaped the notice both of Blanchard and Zambeccari. I do not see how any affinity and relationship between the hydrogen gas in the balloon, and that component of the water, could ever cause the effect described. We are not prepared to reason upon a thing before we are well assured that it, in fact, exists.

"Umbra Montgolfieri" proposes to construct the lower portion of a fire-balloon of asbestos or woollen stuff. This is not necessary. The solution of alum in water renders paper, cotton, or linen, quite incombustible. The balloon (or any balloon) may be made so as of itself to answer the purpose of a parachute, by fixing a broad hoop of beech-wood around its meridian. I am aware of the non-conducting qualities of silk and of hydrogen gas; but should an electric spark happen to pass through the mixture of gas and atmospheric air, which occurs on every opening of the valve, I should not like to be in the car at the time.

Should any such Aeronautic Club, as is proposed by "Umbra," ever come into existence, I shall be glad to furnish all the assistance in my power; but I really do not think that *any kind of balloon* is worth the attention of men, who wish to devote their time and labour to objects of utility and benefit to mankind.

I have the honour to be, Sir,
Your obedient servant,
F. Maceroni.

CAPTAIN ERICSSON'S PATENT SOUNDING-INSTRUMENT.

"His Majesty's brig Partridge, 10, Lieutenant Bisson, returned on Tuesday from a cruise to the westward, where she had been despatched for the purpose of trying a new sounding-machine invented by Captain Ericsson, who personally superintended the experiments. We understand that this machine is found to answer remarkably well. It has been tried in currents and in heavy seas, and was found perfectly serviceable when going seven knots, with a depth of 600 fathoms."—*Devonport Telegraph*.

We have been favoured with a copy of the certificate granted by Commander Bisson to Captain Ericsson, which we have great pleasure in subjoining:—

"*To Captain Ericsson.*

"My Lords Commissioners of the Admiralty having ordered a trial of your patent sounding-instrument, I was directed by Rear Admiral the Honourable Sir Charles Paget, on the 12th of this month, to proceed in his Majesty's brig Partridge, under my command, towards the Atlantic Ocean for that purpose. I have accordingly to certify, that I have put your sounding-instrument to a complete practical test, by using it every second hour by day and by night for nine days, beginning with a depth of 5 fathoms, and extending to 600 fathoms. Soundings up to 80 fathoms being obtained whilst going at the rate of 6 knots per hour.

"Respecting the accuracy of the instrument, I have only to state that I found it perfect, and as to simplicity, I need only say that all my crew soon understood its use, and on these grounds I can strongly recommend this instrument as being of great practical utility.

"Philip Bisson, Lieut. and Com.

"Plymouth, this 22nd day of Sept., 1836."

ELECTRICAL THEORY OF THE UNIVERSE.

Sir,—I really wish your correspondent, Mr. Mackintosh, would endeavour to be a little more consistent in his explanations of his electrical theory of the universe. In No. 645 he asserts, that his theory is in accordance with Kepler's laws; and in No. 681 he denies it. He perhaps found that he could not grapple with the demonstrations I gave in No. 680, in opposition to the theory of his five moons; and rather than acknowledge his error on this part of the subject, he shifts his ground, and allows that his

theory is not in accordance with Kepler's laws. Well, I gave up this point to him, which I did the more readily, as I was well convinced it was the fact. But in No. 683 he makes another turn-about, and tells me, "that in the end I will find that his theory is not at variance either with the laws of Kepler nor the theory of Newton;—that the electrical theory is an extension of the principles of universal gravitation; and that with some qualifications it is in perfect accordance with Kepler's laws," &c.: and how does Mr. Mackintosh prove all this? Why, by informing us, "that the intensity of electricity, like that of gravitation, is in the inverse ratio of the squares of the distances." If this can be called a demonstration, it is not a long one. It belongs to that sort of information which the Scotch Highlanders designate by the name of "Piper's news." But the intensity of magnetism, heat, light, and many more, follow the same law. It appears that Newton made a great many experiments for discovering the law of magnetic action, but he could discover nothing that would render it susceptible of a comparison with the solar force.

But let us draw the veil a little aside, and see if we can discover whether Mr. Mackintosh's theory has any great claims to originality. In the first place, Mr. M. informs us, that all the planets belonging to the solar system were originally comets revolving round the sun in very elliptic orbits," &c. Now that great cosmographer, William Whiston, sometimes nicknamed "Wise Willie" (the same Mr. Whiston whom your able correspondent, "Zeta," speaks of in his letter, No. 670), informs us that our earth had originally been a comet revolving round the sun in an elliptic orbit, which gradually was changed so as to come into a circular one at the time of the Mosaic creation," &c. The only difference between the two accounts is, that Mr. Whiston only speaks of the earth being a comet before the Mosaic creation. Mr. Mackintosh assigns no period of time. But besides the earth being a comet, he lugs in all the other planets belonging to the solar sytem. Again, Mr. Mackintosh tells us that all the planets and comets belonging to our system originally formed a part of the body of the sun," &c. Buffon says, "That *a large comet* coming with great velocity to its perihelion, fell with such a force obliquely upon one side of the globe of the sun, as to strike off therefrom in a stream so much matter as the masses of all the planets amount to; that part of this stream being of different densities, were by the force of this impulse driven to different distances from the sun; some of the lightest were carried as far as the orbit of Saturn, and there. by mutual attraction, were compacted together, and formed that with its ring and satellites, and so on of all the other planets. So that it appears that the cosmographical part of Mr. Mackintosh's theory is, with some modifications, only an attempt to revive the philosophical vagaries of Whiston and Buffon. The terrible catastrophe, which, by Mr. Mackintosh's account is to be the fate of all the planets that now belong to our system (or the roasting system, so named by an old correspondent), is nearly akin to the opinions of Dr. Burnet, another of our great modern cosmographers. The old Scotchwoman's account of the formation of the fixed stars, appears fully as feasible as any of them, who, when asked what became of all the old moons, glibly replied, "That she did not exactly ken, but to the best of her knowledge and belief, they were all cut up to make stars of." But to be serious. Of all the opinions that have been given on this subject by uninspired writers, both in ancient and modern times, that of Plato for genuine orthodoxy, throws them all in the shade.

Plato asserts, "That the world was created in time, but that the idea thereof subsisted in the divine mind from all eternity; that God, induced by his goodness, created it when he thought fit; that when the matter whereof the world consists was before altogether in a confused chaotic state, the Divine being reduced it into order, and gave it a perfect form, *which nothing can impair or change but the same power that made it; and that it will continue in the same state for ever*, because it is not reasonable to imagine that a wise and benevolent Being will destroy his own work, which he beheld with pleasure as soon as he had finished it."

I should now go on to make some observations on the mechanism which Mr Mackintosh asserts gives motion to the different planets belonging to our system,

but my avocations at present prevent it. I will also bestow a few lines on the rather growling remarks made by my friend *Ursa* in his last letter; and if no other should, I will also make some remarks on an old correspondent's letter, which contains another example of the periodical folly of some men.

I am, Sir, yours, &c.

KINCLAVEN.

Sept. 26, 1836.

ON THE TRANSPORT OF HEAVY BURTHENS UPON ICE. BY THOMAS JEFFERSON CRAM, PRIN. ASSIST. PROF. OF NAT. AND EXP. PHILOS., U. S. MILITARY ACADEMY.

(From the *Journal of the Franklin Institute.*)

For ordnance purposes, it became necessary, on the 13th of January, 1835, to transport a heavy piece of artillery (an iron 24-pounder) across the Hudson, from West Point to Cold Spring Foundry. To insure safety, two ox sleds were connected, one after the other, and upon which two timbers were longitudinally placed and secured; between these timbers, the gun, previously dismounted from its carriage, was swung, by resting its trunnions upon them, at such points that the whole pressure was distributed, as uniformly as possible, upon the ice which sustained it. A pair of horses were attached to another sled, which was connected with the foremost of those before-named, by a rope about thirty feet in length.

The ice over which the gun was taken, had been chiefly formed during that intensely cold week (in January, 1835), when the mercury in Fahrenheit's thermometer ranged, here, between $-2\frac{1}{2}$ and -15. The effects of the pressure upon the ice were carefully observed, by myself, along the entire route, and were such as to induce the belief, that an idea of its strength could be formed with sufficient certainty to be of practical utility, in all cases where the safety of transporting any load upon ice might be jeoparded.

The ice was drilled through, and its thickness measured, to a tenth of an inch, at intervals of two hundred paces and less, along the whole extent of the track. From the place of departure to the channel of the river, the thickness diminished from 16·5 inches down to 8 inches, and no signs of cracking or bending were observed in the ice—the horses going at the rate of about four miles an hour. Across the channel, the thickness increased from eight inches to 12 inches, and no evidence of breaking or bending was exhibited,—the load moving with a speed of about eight miles an hour. From the west edge of Cold Spring flats, to the vicinity of the entrance of a creek, the thickness varied from 12 inches up to 15·5 inches, and no indications of yielding were perceived, the horses going at a gentle trot. Near the entrance of the creek, for an extent of fifty paces, the average thickness of the ice was only 5·56 inches, and it was covered with a sheet of snow water, two inches in depth. This fifty paces of ice was observed to bend so much under the gun, that I was very apprehensive of its breaking; indeed, had the load been stopped for a few seconds only, it undoubtedly would have gone to the bottom. The depression along here was at least two inches, and the flexure of the ice under the foremost of the sleds, bearing the gun, was less than that under the hindmost, owing to its being weakened by the former, ere the latter came upon it. On crossing this weak spot, the horses had become so much fatigued, and the resistance increasing, by being drawn up the inclined surface of the bending ice, that, with much whipping and shouting they were barely urged to drag the gun safely over, at a velocity of about four miles an hour.

To determine the pressure sustained by a given superfices of the ice under consideration, it is to be remarked, first, that from the dimensions of the bottom surfaces of the four sled runners under the gun, the whole surface of ice in contact with these bottom surfaces, at the same time, was 6·458 square feet. 2nd. That the weight of the gun is marked 5579 lbs., and the sleds supporting it, together with the timbers, lashing chains, wedges, blocks, &c., weighed, in all, 1624 lbs., one sled weighing as much as the other. 3rd. That the horses and their sled were so far in advance, the pressure arising from this cause may be neglected, inasmuch as it did not act at the same time, and upon the same ice, with that arising from the gun.

Therefore, the whole pressure sustained by the 6·458 square feet of ice, at the same time, was equal to $5579 + 1624$ lbs., or equal to 7203 lbs.; and admitting, what was very nearly the truth, that the pressure was distributed uniformly, and dividing 7203 by 6·458, we shall have 1115·361 lbs., for the pressure sustained by each square foot; at all events, 1115·361 lbs. will be the *average* pressure sustained by a square foot of the ice.

From the observed effects upon the fifty paces of ice at the entrance of the creek, one can form a pretty accurate estimate of the *least* thickness upon which we can *safely* bring a pressure (of $1115·361 + 10$) equal to 1125·361 lbs., (the ten additional pounds being the allowance for the covering sheet of water). It is evident that the ice will *not be safe*, if its thickness be not above 5.56 inches.

From the foregoing facts, which were obtained with the greatest care, it may be in-

ferred, 1st, That a load may be transported with perfect safety over sound ice, eight inches in thickness, by distributing the entire weight of the system, so that each square foot (in contact with the bottom surfaces of the runners) shall experience a pressure of not more than about 1115 lbs. 2nd. That a load *cannot be safely* transported over sound ice, 5·56 inches thick, when the weight is so distributed, that each square foot of surface (in contact with the bottoms of the runners) shall experience a pressure so great as about 1125 lbs.

CONSTANT CURRENTS OF WIND AT HIGH ALTITUDES.

Sir,—I think that if, as has been lately stated, there are at different altitudes opposite currents of air always blowing in the same direction, aerostation may, nothwithstanding all that has been said about it, prove a pleasant but sure method of travelling to the Continent and back again. Now, as is well known, directly any portion of the atmosphere gets heated, it becomes rarefied, and as such it is lighter than it was before, and consequently it rises, and the cooler air rushes into the space that it before occupied, and thus forms a wind. As the sun may be considered always over the equator, the air directly under it, or that in the middle of the torrid zone must become considerably warmed, and consequently rise, and there must be a corresponding rush of cooler air below from the north and south to supply its place. That there is such, is known in the form of the trade winds, and the reason of their not being due north and south is owing to the whirling of the earth; but the heated air becoming cooled as it ascends, must in the upper regions form an opposite blast to the trade winds; and it has been clearly seen that there is such, by large masses of clouds being observed rapidly moving at a great height in a contrary direction to the wind, at the surface of the earth. A balloon taken to almost any part, within thirty degrees of the equator, would quickly ascertain at what height the change took place, and *ballooning* might prove of utility out there, if it never does in this country. Although the winds near the earth in the temperate zones are not, from various local *circumstances*, very steady, there is great *probability* that there may be different currents at some height, and it could be easily ascertained by a few aerial trips made by an experienced person on purpose for that intent.

With respect to guiding balloons by sails, supposing that by placing them obliquely you were enabled to obtain a little side way, it would, I think, be too trifling, compared with the length you would have gone in the same time with the wind, to be of any practical advantage, and to compensate for the greater size and expense of the balloon. It is as unreasonable, in the words of Dr. Arnott, to suppose that an insect, driven along at the rate of eight or ten miles an hour by a river torrent, should have power to stop or sail against the stream, as a man in a balloon by means of wings or sails, could resist or change a motion in the air generally exceeding fifty miles an hour.

I remain Sir,
Your obedient servant,
VINCENT BROWN.

BALLOONING.

Sir,—It gives me great pleasure to perceive that an attempt is about to be made to turn air-balloons to some useful account; and that the conduct of the undertaking is likely to be intrusted to the active mind and enterprising spirit of Colonel Maceroni. Perhaps the whole amount of utility to be derived from air-balloons is very limited; but they are not on that account to be disregarded. We must not despise small things; the happiness of mankind, such as it is, is made up of a number of small enjoyments. It is a pity, I had almost said it is a disgrace to an intelligent nation, that this interesting art should be allowed to remain in its present worse than useless state. At all events, the mere attempt to advance it is honourable; whilst the failure can be no disgrace.

The difficulty consists simply in this:—The resistance is greater than any power that has been hitherto applied to overcome it. To meet this difficulty, we must *increase the power* and *decrease the resistance.*

With respect to the power, I would refer Colonel Maceroni, and your readers generally, to a paper on that subject in No. 637 of the Mechanics' *Magazine.* To decrease the resistance, the present

globular form of the balloon must be rejected altogether; nothing can be done whilst this shape is retained. It appears to me that an oblate cone offers the largest capacity with the smallest resistance, or rather a cylinder with conical ends. The cylinder might be kept in a compressed form by connecting the opposite sides by means of cords in the interior of the balloon, so as to allow of its being distended by the gas in a lateral direction only. Colonel Maceroni objects, that the cone might rise endwise, or any way but the desired one. This may be easily guarded against by having the interior divided into several compartments, so as to prevent the gas from shifting.

I am convinced that the difficulties and obstacles which at present appear to stand in the way of this undertaking, may be overcome by ingenuity and perseverance—and that in *calm weather* a balloon might be conducted with safety and certainty in any direction that the aeronaut might desire to steer.

I am, Sir,
Your obedient servant,
T. S. Mackintosh.

Sept. 26, 1836.

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 1st OF SEPTEMBER AND 22d OF SEPTEMBER, 1836.

Robert Griffiths, of Birmingham, machine-maker, and John Gold, of the same place, glass-cutter, for certain improvements in machinery for grinding, smoothing, and polishing plate-glass, window-glass, marble, slate, and stone, and also glass vessels and glass spangles and drops. September 1; six months to specify.

John Pickersgill, of Coleman-street, merchant, for improvements in preparing and in applying India-rubber (caoutchouc) to fabrics: being a communication from a foreigner residing abroad. September 1; six months.

James Surrey, of York House, Battersea, miller, for a new application of a principle by which mechanical power may be obtained or applied. September 1; four months.

William Bush, of Wormwood-street, Bishopsgate Within, surveyor and engineer, for improvements in the means of, and in the apparatus for, building and working under water, part of which improvements are applicable for other purposes. September 3; six months.

Charles Farina, of Clarendon-place, Maida Vale, Middlesex, gentleman, for an improved mashing-apparatus. September 15; six months.

William Hinckes Cox, of Bidminster, near Bristol, tanner, for an improvement or improvements in tanning hides and skins. September 15; six months.

John Frederick William Hempel, of Oranienburg, Prussia, but now of Clapham, Surrey, Officer of Engineers, and Henry Blundell, of Hull, Yorkshire, paint and colour-manufacturer, for an improved method of operating upon certain vegetable and animal substances in the process of manufacturing candles therefrom; being a communication from Frederick Hempel, of Oranienburg, aforesaid, deceased. September 15; six months.

Joshua Bates, of Bishopsgate-street, London, merchant, for improved apparatus or machinery for making metal hinges; being a communication from a foreigner residing abroad. September 15; six months.

Peter Ascanius Tealdi, formerly of Mendovi, in Piedmont, but now residing in Manchester, Lancashire, merchant, for a new extract or vegetable acid, obtained from substances not hitherto used for that purpose, which may be employed in various processes of manufacture and in culinary or other useful purposes, together with the process of obtaining the same: being a communication from a foreigner residing abroad. September 15: six months.

William Bates, of Leicester, fuller and dresser, for improvements in the manufacture of reels for reeling cotton. September 16; six months.

Moses Poole, of Lincoln's Inn, Middlesex, gentleman, for improvements in the description of public vehicles called cabs; being a communication from a foreigner residing abroad. September 21; six months.

Robert Jupe, of Bond-street, Middlesex, cabinet-maker, for improvements in apparatus applicable to book and other shelves. September 22; six months.

William Crofts, of Radford, Nottinghamshire, machine-maker, for certain improvements in machinery for bobbin-net lace, also called twist-net or lace, part of which improvements are for the purpose of making figured or ornamented bobbin-net lace, or figured or ornamented twist-lace. September 22; six months.

Henry Van Wart, of Birmingham, Warwickshire, gentleman, and Samuel Aspinall Goddard, of the same place, merchant, for certain improvements in locomotive steam-engines and carriages, parts of which improvements are applicable to ordinary steam-engines and other purposes. September 22; six months.

John Smith, of Halifax, Yorkshire, dyer, for certain improvements in machinery for dressing worsted and other woven fabrics. September 22; six months.

LIST OF SCOTCH PATENTS, GRANTE DBETWEEN THE 21st OF AUGUST AND 22d OF SEPTEMBER, 1836, INCLUSIVE.

John Sharp, of Dundee, N. B., flax-spinner, for certain machinery for converting ropes into tow, and certain improvements in preparing hemp or flax for spinning, also certain improvements in certain machinery for the preparation thereof for spinning, part of which improvements are also applicable to the preparing of cotton, wool, and silk, for spinning. Sealed August 24.

James Champion, of Manchester, machine-maker, for certain improvements in machinery for spinning, twisting, and doubling cotton and other fibrous substances. August 31.

John Springall, of Oulton, Suffolk, iron-founder, for an improved mode of manufacturing certain parts of ploughs. September 2.

Richard Thomas Beck, of Little Stonham, Suffolk, gentleman, in consequence of a communication made to him by a foreigner residing abroad, for a new or improved apparatus or mechanism for obtaining power and motion, to be used as a me-

chanical agent generally, which he intends to denominate rotæ vivæ. September 10.

Henry Scott, jun., and Robert Stephen Oliver, hatters, of Edinburgh, in consequence of a communication from abroad, for a certain improvement or improvements in the manufacture of hats, caps, and bonnets. September 10.

Elisha Haydon Collier, of the East India Cottage, City-road, Middlesex, formerly of Boston Massachusetts, U. S., civil engineer, for an improvement or improvements in steam-boilers. September 20.

William Barnett, of Brighton, founder, for certain improvements in apparatus for generating and purifying gas for the purposes of illumination. September 21.

NOTES AND NOTICES.

Submarine Illumination by the Drummond Light.—We find by the Irish newspapers, that Mr. Steele, who has devoted himself with so much ardour to the subject of submarine operations, and who is the inventor of the communicating diving-bell, has lately made a very important improvement in this department of physical science. This improvement consists in the substitution for the light which he originally proposed for the irradiation of objects under water, of what he calls "the piercing ray of the Drummond light in its gorgeous glory." He has consulted several highly distinguished engineers of the metropolis, and they have been unanimous in their opinion, that this new application of the Drummond light is an improvement of the greatest importance, and it is impossible that any thing can be more simple than the mode proposed by Mr. Steele for its application to his purpose. It appears from the Irish newspapers that this improvement in his theory was made by him while observing Mr. Deane's operations at Kilkee, on the coast of the county Clare. We have seen several of Mr. Steele's publications on this subject in the journals of our Irish contemporaries, and he writes in terms of measureless admiration of the infinite beauty and perfection of Mr. Deane's system of rapid diving. Among the London engineers who have expressed the highest approbation of Mr. Steele's new theory of submarine irradiation by the Drummond light, is, we understand, Mr. Alexander Gordon, who has particularly applied himself to the subject, and lately obtained a patent for a very beautiful mode of generating and applying the oxy-hydrogen gas.—*Sun.*

Manumotive Carriage.—A mechanic, a whitesmith by trade, named Nicholson, of the town of Enniscorthy, has invented a new carriage, on most simple principles. It is very ingeniously constructed, having three wheels, one in front and two behind—the latter about three feet in diameter, the former one and a half. It is propelled by an iron handle, which the guide moves to and fro with the right hand, and not tiresome, being quite a gentle motion; on the left there is a small lever, to be touched by the finger when any obstruction appears on the road, which raises the first wheel over such impediments, and prevents the guide from receiving any shock or interruption. Then over the small wheel there is a handle, or tiller-stick, to be touched when the driver wishes to turn the gig, and which is done instantaneously; there is another spring for the foot, which retards the progress of the machine. The maker is quite confident of its ultimate success, and says he can improve on the general principle, the present model being too small to contain more than one person; and we suppose the driver or guide would work it for eight or ten miles without tiring. It has taken the artist some years in its completion, and we wish him every success and encouragement to which his genius and industry justly entitle him.—*Dublin Paper.*

Another Locomotive-Engine for Russia.—On Thursday, the 15th of September, a large and powerful locomotive-engine, built by Mr. Timothy Hackworth, of New Shildon, for the Emperor of Russia, was shipped on board the *Barbara*, at Middlesbro'. This engine is constructed on an improved principle, and finished in the best manner. She has been tried on the premises, and propelled at the rate of 72 miles per hour. It is said that this machine, and the similar one built at Newcastle, will, on their arrival at St. Petersburgh, have cost the Emperor upwards of 2,000*l.* each. Who, a few years ago, would have dreamed of the exportation of machinery from the river Tees. This engine is for travelling on the railroad from St. Petersburgh to Pawlowsky, where stands one of the country palaces of his Imperial Majesty.—*From a Correspondent.*

Magnetic Balance.—Could not small philosophical scales be more nicely suspended by magnetism than by the present method; with the precaution, to use no metal in their construction acted on by magnetism, except the centres, the edges of which must be reversed?—Tyro-Mechanicus.

Correction.—Sir, If you will review p. 383, you will find that some alteration of the manuscript text of that paper on "The Tides"—through inadvertent omission, I apprehend—has rendered the passage unintelligible as it there stands. I therefore beg leave to send you the subjoined emendation, in failure of the original being at hand:—"It is manifest that atmosphere, a transparent firmament, is interposed to conduct (not originate, it to qualify the hues by extraneous floating particles of moisture,) the light, however distant; rather than, by a property at variance with its fitness as medium of all rays, to impede their progress to recipient vision."—W. Fra. Godolphin Waldron, Sept. 15, 1836.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

A complete list of Patents from the earliest period (15 Car. II. 1675,) to the present time may be examined. Fee 2s. 6d.; Clients, gratis.

Patent Agency Office,
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END OF THE TWENTY-FIFTH VOLUME.

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TO THE TWENTY-FIFTH VOLUME.

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NOTES AND NOTICES.

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